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**Programme planning**

**Report on the activities of the Office of Internal Oversight Services**

# Strengthening the role of evaluation and the application of evaluation findings on programme design, delivery and policy directives

## Report of the Office of Internal Oversight Services

*Summary*

In accordance with regulation 7.4 of the Regulations and Rules Governing Programme Planning, the Programme Aspects of the Budget, the Monitoring of Implementation and the Methods of Evaluation (ST/SGB/2000/8), the present report is the thirteenth in a series of studies that have been submitted to the General Assembly through the Committee for Programme and Coordination. Using both qualitative and quantitative methods and covering the 2010-2011 biennium, the Office of Internal Oversight Services (OIOS) assessed the Secretariat's evaluation capacity, quality and utility and identified key results contained in evaluation reports. This biennial study also presents the OIOS evaluation workplan for 2014-2015 and describes OIOS follow-up to prior Committee recommendations aimed at improving the quality of Secretariat evaluations.

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Despite the degree of progress made during the prior biennium, such as greater integration of gender perspectives into evaluation, overall evaluation capacity in the Secretariat remains uneven and inadequate. Evaluation resources are still insufficient, and the organizational framework, culture and commitment needed to promote and facilitate a comprehensive evaluation function that provides critical, timely and strategic information for decision-making and strengthens accountability and learning are lacking. Important processes for evaluation planning, conduct and follow-up are not systematically implemented, evaluation policies are not always in place, and the competencies of staff conducting evaluations are uneven. Furthermore, some focal points reported a lack of the management support for and buy-in of evaluation that are necessary for the building of a strong evaluation culture. These factors have contributed to the limited utility of evaluation, with significant gaps in evaluation coverage causing large areas of the Organization to lack evaluative evidence on performance to guide strategic decision-making.

Since the previous biennium, the quality of evaluation reports has improved marginally, with 49 per cent of reports reviewed assessed as being of excellent or good quality overall. At the operational level, there is a need for more self-evaluation support in the form of training, the sharing of lessons learned and technical guidance.

In its resolution 67/226, the General Assembly emphasized the importance of having independent, credible and useful evaluation functions, with sufficient resources, and a culture of evaluation that ensures the active use of evaluation findings and recommendations in policy development and improving the functioning of the organizations of the United Nations. This ambition has not yet been reached in the Secretariat, where evaluation has yet to become a fully robust function that is integral to how the Organization operates. To that end, the critical gaps identified above must be addressed.

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# I. Introduction

1. The present report is the thirteenth in a series of studies that have been submitted biennially since 1988 to the General Assembly through the Committee for Programme and Coordination, in accordance with the Regulations and Rules Governing Programme Planning, the Programme Aspects of the Budget, the Monitoring of Implementation and the Methods of Evaluation (ST/SGB/2000/8).[1] The report was reviewed by Secretariat departments and offices, and their comments were incorporated as appropriate.

2. The purpose of this biennial study was to describe and assess the status of evaluation in the United Nations Secretariat, as well as to identify the key issues emerging from evaluations conducted during the 2010-2011 biennium. It was focused specifically on:

(a) The current capacity, quality and utility of the evaluation function within and across the Secretariat;[2]

(b) Key results and conclusions contained in evaluation reports finalized during the biennium 2010-2011.

3. In addition, the study presents the evaluation workplan of the Office of Internal Oversight Services (OIOS) and reports on OIOS follow-up to recommendations made by the Committee for Programme and Coordination following the issuance of the previous biennial study. OIOS plans a follow-up report containing programme-by-programme scorecards, including more detailed data regarding evaluation capacity and practice.

4. In concluding the twelfth biennial Office of Internal Oversight Services study, the Committee for Programme and Coordination emphasized that evaluation was a key function for the adoption of budgetary decisions, since it not only helped to improve programme design and execution, as well as the formulation of policy directives, but also contributed to transparency, effective implementation of intergovernmental mandates and the maximization of the use of resources. At the same time, it allowed Member States to follow up on programme outcomes in a systematic way.[3]

5. In the context of that conclusion, and on the basis of the United Nations Evaluation Group (UNEG) Norms and Standards for Evaluation in the United Nations system,[4] evaluation in the Secretariat should serve two fundamental purposes: (a) to provide for programme accountability to Member States, senior leadership and beneficiaries; and (b) to determine programme effectiveness and lessons learned with a view to programme improvement. A comprehensive and robust evaluation function answers the following three critical questions: Are we doing the right things? Are we doing them right? Are we doing them on a sufficient scale to make a difference?

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[1] The report responds to regulation 7.4, which requires that a brief report summarizing the conclusions of the Secretary-General on all evaluation studies be submitted to the General Assembly at the same time as the proposed medium-term plan (now the "strategic framework").

[2] In this study, "the Secretariat" refers to the 33 programmes within the mandate of OIOS, as identified in annex I.

[3] A/66/16, para. 58.

[4] UNEG/FN/Norms(2005) and UNEG/FN/Standards(2005).

6. There are two types of evaluations in the Secretariat: (a) independent evaluations undertaken by OIOS, in which the evaluation function is external to the programmes being evaluated; and (b) self-evaluation undertaken by the programmes themselves, either as part of a dedicated evaluation unit or otherwise, in which the evaluation function is embedded within the programmes being evaluated. OIOS also undertakes cross-cutting thematic evaluations that address issues of strategic importance across the Organization. Both types of evaluation are complementary and necessary to ensure a comprehensive evaluation approach throughout the Secretariat.

## II. Methodology

7. This study was conducted using the following six methods:[5]

(a) A quantitative and qualitative analysis of evaluation reports finalized in 2010-2011 to determine their attributes, quality and key results and conclusions (see annex II for information on how those reports were collected and selected for the analyses);

(b) A web-based survey of Secretariat programmes. The survey was conducted from November to December 2012 and had a 100 per cent response rate;[6]

(c) In-person or telephone interviews with focal points;[7]

(d) An assessment of evaluation policies;[8]

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[5] The universe for this biennial study is 33 entities. The United Nations Entity for Gender Equality and the Empowerment of Women (UN-Women) became operational only in 2011; therefore, analyses for it reflected a prior organizational structure.

[6] The survey was conducted with 32 entities; OIOS did not participate. This will be referred to as the "focal point survey" in the present report. Not all information reported in the survey was independently verified by OIOS; in these cases, OIOS states that information is self-reported. The 32 programmes surveyed were represented by 36 focal points; the Department of Management had multiple focal points, and not all of them responded. Finally, not all survey responses were complete; percentages reported are based on the denominator of responses to a specific question.

[7] Interviews were conducted with focal points from 29 entities; OIOS did not participate, and the same focal point responded on behalf of the Department of Peacekeeping Operations and the Department of Field Support. OIOS was unable to schedule interviews with the Economic Commission for Africa (ECA), the Department of Safety and Security and the Office of the Special Adviser on Africa.

[8] The evaluation policy assessment covered 17 entities. The following did not have evaluation policies finalized by 2010: the Department of Economic and Social Affairs, the Department of Political Affairs, ECA, the Department of General Assembly and Conference Management, the Department of Management, the Department of Public Information, the Department of Safety and Security, the Executive Office of the Secretary-General, the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, the Office of Legal Affairs, the Office of the Special Adviser on Africa, the United Nations Human Settlements Programme (UN-Habitat), the United Nations Office at Geneva and the United Nations Office at Vienna. OIOS was not included in the analysis, and the Department of Peacekeeping Operations and the Department of Field Support had the same policy. For UN-Women, the evaluation policy of the former United Nations Development Fund for Women was reviewed.

(e) An assessment of evaluation budgets;[9]

(f) Workshops with focal points to discuss evaluation capacity benchmarks.[10]

8. One limitation of the study was that OIOS might not have received all evaluation reports finalized during 2010-2011, although the Office guided focal points on the submission of reports from their respective entities. An additional limitation was that the non-random sampling of reports to determine their attributes, quality and content may have limited the extent to which the study results can be generalized, including the comparison of data among the past three bienniums. Finally, the quality of evaluation was determined primarily through an assessment of evaluation reports.

9. To balance those potential limitations, all analyses were triangulated with data from the data sources identified in paragraph 7 above, in order to strengthen the study results.

# III. Study results

## Current evaluation capacity, quality and utility

## A. Evaluation capacity in the Secretariat remains uneven and inadequate

10. Among its conclusions regarding the previous biennial study, the Committee for Programme and Coordination stated: "The Committee stressed that appropriately balanced competencies and strong commitment from staff at all managerial levels, including senior leadership support, as well as sufficient financial and staffing resources, were among the main elements required to ensure adequate conduct of evaluation activities in the Secretariat."[11]

11. In order to assess current evaluation capacity in the Secretariat, OIOS reviewed the following key indicators, each of which is discussed below:

- Resources
- Structure
- Processes
- Culture
- Competencies.

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[9] The evaluation budget assessment covered 32 entities; the budget of UN-Women was not analysed, because the Entity became operational in 2011.

[10] The workshops covered 21 entities. OIOS was not included, and the following did not attend: the Executive Office of the Secretary-General, the Economic and Social Commission for Asia and the Pacific (ESCAP), the Economic and Social Commission for Western Asia (ESCWA), the International Trade Centre (ITC), the Office for Disarmament Affairs, the United Nations Environment Programme (UNEP), the Office of the Special Adviser on Africa, the United Nations Office at Vienna, the Office of the United Nations High Commissioner for Refugees (UNHCR), UN-Women and the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States.

[11] A/66/16, para. 64.

12. Despite the degree of progress made during the prior biennium, overall capacity for evaluation in the Secretariat remains inadequate. Evaluation resources are still insufficient, and the organizational framework and culture needed to promote and facilitate a comprehensive evaluation function that provides critical and timely information to inform decision-making and strengthen accountability and results are lacking. Thus, the current commitment to evaluation in the Secretariat is weak; without such commitment, steps cannot be taken to strengthen the function so that it makes a difference in achieving organizational results.

**Resources**

13. The General Assembly, in its resolution 58/269, requested the Secretary-General to ensure that resources are clearly identified in all the sections of the proposed programme budget for the performance of the monitoring and evaluation functions. Each entity submits budget Form 12, indicating resources needed to conduct mandatory self-assessments and discretionary internal evaluations.[12]

14. Monitoring and evaluation resources continue to be insufficient.[13] The Secretariat entities had earmarked 0.29 per cent of their overall budget for monitoring and evaluation.[14] This is 0.07 per cent less than in the previous biennium. Of the Secretariat entities, while 17 had proposed budgets of more than $1 million for monitoring and evaluation, only 10 (one third) spent more than 1 per cent of their total programme budget on those functions.[15] Planned evaluation and monitoring resources for 2012-2013 amounted to $54.8 million, representing 0.33 per cent of the total budget. This is a small relative increase of 0.04 per cent compared with 2010-2011, but lower than the 0.36 per cent of the total budget reflected in 2008-2009.[16]

15. As illustrated in figure 1, when the percentage of the budget allocated to monitoring and evaluation in 2010-2011 is compared with that in 2006-2007, 10 entities had lower shares[17] in 2010-2011. Fourteen spent a lower share of their budget on monitoring and evaluation in 2010-2011 than in 2008-2009.[18]

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[12] For 2010-2011, two entities did not submit Form 12 to OIOS: the Executive Office of the Secretary-General and UN-Women, which was not yet operational in 2010.

[13] While there is no single benchmark for adequate monitoring and evaluation resources, based on various sources, a general guide is between 3 and 5 per cent of the overall budget.

[14] These entities correspond to sects. 2-30 and 34 of the budget.

[15] The analysis did not include the UN-Women budget. The Department of Field Support and the Department of Peacekeeping Operations were calculated jointly.

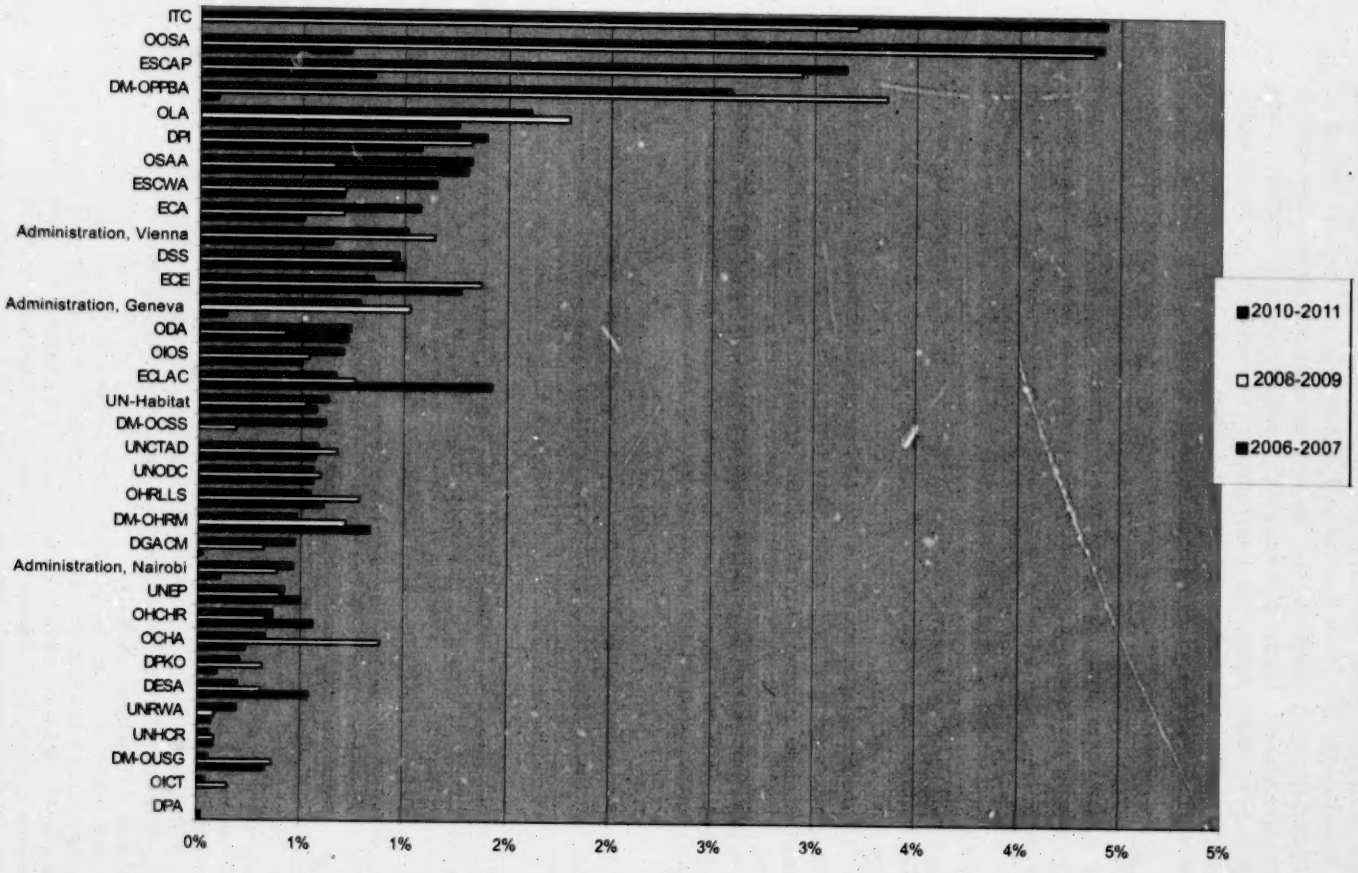
[16] Monitoring and evaluation resources for 2010-2011 were taken from A/66/6, which differs from individual budget fascicles contained in A/64/6, the source used for the remaining analysis.

[17] The Department of Economic and Social Affairs, the Department of Political Affairs, ECE, the Economic Commission for Latin America and the Caribbean (ECLAC), the Office of the United Nations High Commissioner for Human Rights (OHCHR), the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, the Office of Human Resources Management, the Office of the Under-Secretary-General, UNEP and UNHCR.

[18] The Department of Economic and Social Affairs, the Department of Political Affairs, ECE, ECLAC, the Office for the Coordination of Humanitarian Affairs, the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, the Office of Human Resources Management, the Office of Information and Communications Technology, the Office of the Under-Secretary-General, the United Nations Conference on Trade and Development, UNHCR, the United Nations Office on Drugs and Crime, the United Nations Office at Geneva and the United Nations Office at Vienna.

Figure I

**Percentage of budgets of Secretariat entities devoted to monitoring and evaluation, 2006-2011**




*Source*: OIOS analysis using data contained in budget fascicles for 2010-2011 (A/64/6) and figures provided by the Office of Programme Planning, Budget and Accounts.

*Abbreviations*: DESA, Department of Economic and Social Affairs; DGACM, Department for General Assembly and Conference Management; DM, Department of Management; DPA, Department of Political Affairs; DPI, Department of Public Information; DPKO, Department of Peacekeeping Operations; DSS, Department of Safety and Security; ECA, Economic Commission for Africa; ECE, Economic Commission for Europe; ECLAC, Economic Commission for Latin America and the Caribbean; ESCAP, Economic and Social Commission for Asia and the Pacific; ITC, International Trade Centre; OCHA, Office for the Coordination of Humanitarian Affairs; OCSS, Office of Central Support Services; ODA, Office for Disarmament Affairs; OHCHR, Office of the United Nations High Commissioner for Human Rights;

OHRLLS, Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States; OHRM, Office of Human Resources Management; OICT, Office of Information and Communications Technology; OLA, Office of Legal Affairs; OOSA, Office for Outer Space Affairs; OPPBA, Office of Programme Planning, Budget and Accounts; OSAA, Office of the Special Adviser on Africa; OUSG, Office of the Under-Secretary-General; UNCTAD, United Nations Conference on Trade and Development; UNEP, United Nations Environment Programme; UN-Habitat, United Nations Human Settlements Programme; UNHCR, Office of the United Nations High Commissioner for Refugees; UNODC, United Nations Office on Drugs and Crime; UNRWA, United Nations Relief and Works Agency for Palestine Refugees in the Near East.

16. Given the lack of a clear and common understanding of self-evaluation on the part of Secretariat entities, with few exceptions, it continues to be challenging to isolate the resources dedicated solely to evaluation. On the basis of the proposed estimation of work-months submitted on Form 12 for the biennium 2010-2011, it was reported that 53 per cent of overall evaluation resources were dedicated to mandatory self-assessment activities, with 47 per cent dedicated to discretionary self-evaluation activities.[19] This implies that the ratio of evaluation resources to total budget is approximately 0.14 per cent. Of the programmes analysed, only three spent more than 1 per cent of their budget on evaluation and only about one fourth (eight) had evaluation budgets of more than $1 million. However, judging from focal point interviews, no standard method has been established for differentiating between monitoring and evaluation, and thus there is great variation in how the proposed budgets for monitoring and evaluation are reported on Form 12. Many proposed "discretionary self-evaluation" activities are management or operational activities. One programme indicated a budget of almost $3 million for monitoring and evaluation, but its Form 12 showed a significant number of work-months (24 months at the D level, 12 months at the P-5 level and 57 months at the P-4 and P-3 levels) for activities ranging from review meetings and lesson-sharing to the review of reports provided to intergovernmental bodies and staff training. Thus, the actual proportion of resources devoted to self-evaluation in the Secretariat is far lower than the estimated 0.14 per cent of the total budget.

**Structure**

17. As illustrated in the table below, 18 Secretariat programmes had a stand-alone unit dedicated to evaluation, either exclusively or in conjunction with another management function, such as monitoring, programme planning or policy development. Of the 18 programmes with a stand-alone unit, however, only 6 were devoted exclusively to evaluation. According to focal points, the number of unit staff varied from 1 to 10, with none higher than the P-5 level. Only 6 of the 18 units reported directly to the department head. Furthermore, focal points in 18 programmes reported having programme staff who, while not working in a dedicated evaluation unit, were engaged in evaluation on a part-time basis.

18. The lack of a dedicated unit for evaluation in programmes carrying out significant operational activities and contrasted with significant mandates, such as the Department of Political Affairs and the Department of Economic and Social Affairs, is of serious concern. In the forthcoming evaluation scorecards, OIOS will provide further information and suggestions regarding how to fill this gap.

[19] Mandatory self-assessments are internal assessments required in the context of the logical frameworks reported in the programme performance report. Discretionary self-evaluations are internal assessments carried out in addition to required programme performance reporting.

**Evaluation units in the Secretariat**

| *Unit dedicated to evaluation only* | *Unit dedicated to evaluation and other functions* | *No unit dedicated to evaluation* |
|---|---|---|
| DPI | DGACM | DESA |
| DPKO/DFS[a] | ECA | DM |
| UNEP | ECE | DPA |
| UNODC | ECLAC | DSS |
| UNRWA | ESCAP | EOSG |
| UN-Women | ESCWA | ODA |
| | ITC | OHRLLS |
| | OHCHR | OLA |
| | UNCTAD | OOSA |
| | UNHCR | OSAA |
| | UN-Habitat | UNOG |
| | OCHA | UNON |
| | | UNOV |

*Source*: OIOS biennial focal point surveys. OIOS was not included in this analysis.
*Note*: Highlighted evaluation units report directly to the programme head.
*Abbreviations*: DESA, Department of Economic and Social Affairs; DFS, Department of Field Support; DGACM, Department for General Assembly and Conference Management; DM, Department of Management; DPA, Department of Political Affairs; DPI, Department of Public Information; DPKO, Department of Peacekeeping Operations; DSS, Department of Safety and Security; ECA, Economic Commission for Africa; ECE, Economic Commission for Europe; ECLAC, Economic Commission for Latin America and the Caribbean; EOSG, Executive Office of the Secretary-General; ESCAP, Economic and Social Commission for Asia and the Pacific; ITC, International Trade Centre; OCHA, Office for the Coordination of Humanitarian Affairs; ODA, Office for Disarmament Affairs; OHCHR, Office of the United Nations High Commissioner for Human Rights; OHRLLS, Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States; OLA, Office of Legal Affairs; OOSA, Office for Outer Space Affairs; OSAA, Office of the Special Adviser on Africa; UNCTAD, United Nations Conference on Trade and Development; UNEP, United Nations Environment Programme; UN-Habitat, United Nations Human Settlements Programme; UNHCR, Office of the United Nations High Commissioner for Refugees; UNODC, United Nations Office on Drugs and Crime; UNOG, United Nations Office at Geneva; UNON, United Nations Office at Nairobi; UNOV, United Nations Office at Vienna; UNRWA, United Nations Relief and Works Agency for Palestine Refugees in the Near East; UN-Women, United Nations Entity for Gender Equality and the Empowerment of Women.
[a] DPKO and DFS have a shared evaluation unit.

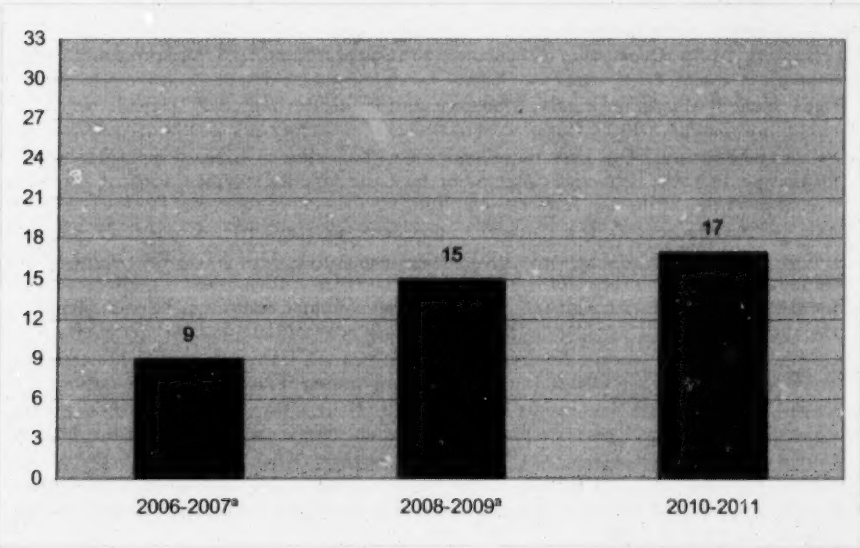
**Competencies**

19. The professional backgrounds of staff responsible for evaluation varied greatly. Only one third of focal points interviewed indicated that these staff had evaluation backgrounds that had equipped them with specific professional competencies and skills. For these programmes, the average number of years of staff evaluation experience was eight. For the remaining programmes, staff responsible for evaluation typically had backgrounds in programme management, finance, economics and other social sciences.

**Processes**

20. While the Regulations and Rules Governing Programme Planning, the Programme Aspects of the Budget, the Monitoring of Implementation and the Methods of Evaluation establish a broad framework for evaluation in the Secretariat, an entity-specific evaluation policy establishes a clear and strong identity for the function. As illustrated in figure II, the number of entities with an evaluation policy has increased over the past three bienniums, although not substantially over the past two: from 9 in 2006-2007 to 15 in 2008-2009 and 17 in 2010-2011. Three more programmes (the Department of Economic and Social Affairs, the Department of Political Affairs and ECA) developed evaluation policies in 2012, and the United Nations Entity for Gender Equality and the Empowerment of Women (UN-Women) developed its policy in 2013. It is noteworthy that 11 programmes still lack an evaluation policy.

Figure II
**Number of entities with evaluation policies, 2006-2011**




*Source*: OIOS review of evaluation policies.

[a] The number of entities reviewed for the bienniums 2006-2007 and 2008-2009 was 31.

21. The evaluation policies generally covered the range of UNEG standards established for such policies. The average rating for programmes was 1.5 on a three-point scale, in which 0 means "no UNEG standards met", 1 means "some UNEG standards met" and 2 means "all UNEG standards met". All 17 policies explained the concept and the role of evaluation. Furthermore, most policies (85 per cent or more) identified a mechanism for follow-up to evaluation results, described how evaluations feed into organizational learning strategies and addressed evaluation planning, although only approximately half stated the criteria utilized in selecting evaluation topics. The greatest weakness was that more than one third (40 per cent) did not clearly identify evaluation staff competencies.

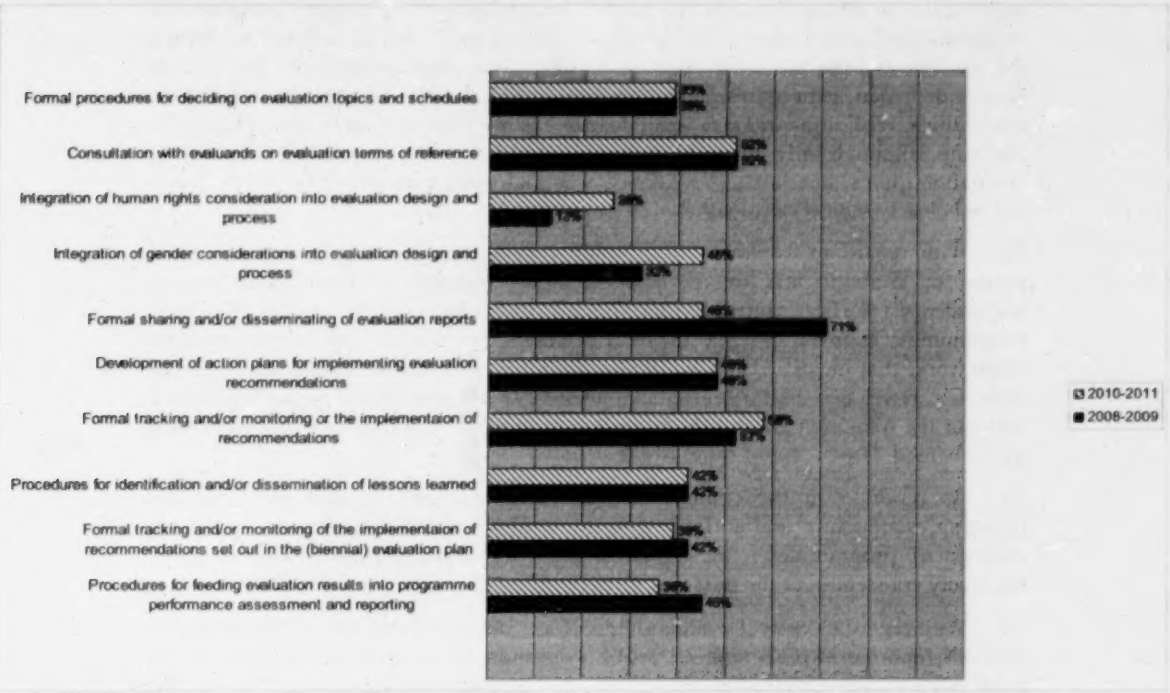
22. With regard to establishing an evaluation agenda that meets organizational needs for strategic and timely information, a majority of focal point survey respondents (68 per cent) reported having an evaluative framework for their programmes, approved by the General Assembly in the context of the strategic framework, that identified related inputs, activities, outputs, outcomes and impacts. However, fewer than half of those respondents (48 per cent) had a formal evaluation plan for the biennium 2010-2011, although of those who did, most reported having implemented 75 per cent or more of the plan.

23. As reported in the context of focal point surveys, critical processes for planning, conducting and following up on evaluation are still lacking in a large number of programmes. The implementation of these processes has remained relatively constant over the past two bienniums, as illustrated in figure III.[20]

24. With regard to critical evaluation processes, the results of the evaluation policy analysis reported in paragraph 20 above were more positive than the results of the focal point survey reported in paragraph 22. There are two reasons for this: (a) the focal point survey covered 32 Secretariat entities, compared with the 17 covered by the policy review; and (b) the fact that evaluation processes are referred to in policies does not necessarily indicate that those processes are implemented.

[20] Data for 2006-2007 were not available.

Figure III
**Evaluation procedures as reported by Secretariat focal points, 2008-2011**


Formal procedures for deciding on evaluation topics and schedules
Consultation with evaluands on evaluation terms of reference
Integration of human rights consideration into evaluation design and process
Integration of gender considerations into evaluation design and process
Formal sharing and/or disseminating of evaluation reports
Development of action plans for implementing evaluation recommendations
Formal tracking and/or monitoring or the implementaion of recommendations
Procedures for identification and/or dissemination of lessons learned
Formal tracking and/or monitoring of the implementaion of recommendations set out in the (biennial) evaluation plan
Procedures for feeding evaluation results into programme performance assessment and reporting
2010-2011
2008-2009

*Source*: OIOS biennial focal point surveys.

25. Several trends have emerged over the past two bienniums. On the positive side, more focal points report the integration of gender into the design and process of evaluation (45 per cent in 2010-2011, compared with 32 per cent in 2008-2009), and more programmes also report the integration of human rights into their evaluations, although the level of such integration remains inadequate (26 per cent in 2010-2011 compared with 13 per cent in 2008-2009). On the negative side, fewer focal point survey respondents reported the formal sharing and/or dissemination of evaluation reports (45 per cent in 2010-2011, a significant decrease compared with 71 per cent in 2008-2009). Focal points interviewed identified various ways in which evaluation results were shared, including formal and informal meetings with programme managers, website publication and management responses. They suggested that evaluation results could be better disseminated through formal communication strategies and better knowledge management. In fact, fewer than half of focal point survey respondents (42 per cent) reported having a formal procedure for the dissemination of lessons learned from evaluations.

### Culture

26. The Secretariat evaluation culture remains insufficient to foster a robust function in which evaluation is seen as adding value to organizational performance; this insufficiency contributes to the low amount of resources devoted to evaluation, the limited degree of dedicated and independent evaluation capacity and the absence

of an evaluation policy in half of the entities of the Secretariat. Focal point survey respondents observed that lack of buy-in on the part of management was one of the biggest obstacles that their programmes faced in conducting and utilizing evaluation in 2010-2011, and the need to strengthen management support was cited as a critical factor that needed to be addressed in order to strengthen evaluation. This has not changed since the biennial study for 2008-2009, in which it was reported that evaluation had yet to become a fully accepted management function.[21]

27. Interviews with focal points revealed that lack of an evaluation culture was an impediment to strong evaluation. One third of respondents made this point, stating that the lack of an evaluation culture was having adverse effects on efforts to move towards a results-based environment. They also stated that a lack of human and financial resources prevented the building of a culture that supported and promoted evaluation. In addition, some suggested that a lack of attention on the part of senior management with respect to evaluation resulted in sporadic and non-systematic evaluation. Their recommendations for strengthening the evaluation culture in the Organization included the setting and enforcement of standards across the Secretariat for evaluation planning, resource requirements and the dissemination of evaluation results.

28. Focal points identified the need for greater self-evaluation support, such as more training, specifically on the practical application of evaluation; more sharing of lessons learned to feed into programme design and implementation; and greater technical guidance on the conduct of evaluation.

29. Focal points also suggested that there was a need for greater liaison with OIOS. This included the Office advocating and promoting evaluation in the Secretariat as well as providing guidance on Secretariat-wide standards, derived from UNEG norms and standards, for the conduct of evaluation.

## B. Overall evaluation productivity and quality in the Secretariat have remained stable, and there is still significant room for improvement to enhance the quality of the evaluations conducted

30. Overall, the number of evaluation reports produced within the Secretariat has been stable. In 2010-2011, OIOS determined that there were 153 evaluations across the Secretariat, compared with 155 in 2008-2009 and 168 in 2006-2007. However, evaluation activity is more concentrated in a few entities. In 2010-2011, the top five entities in terms of evaluation output accounted for 77 per cent of all evaluation reports; in comparison, in 2008-2009 the top five accounted for 46 per cent of all reports, and in 2006-2007 they accounted for 65 per cent. Thus, while overall numbers have remained constant, there are significant gaps in evaluation coverage, with large parts of the Organization not subject to evaluation and therefore lacking evaluative evidence on performance to guide strategic decision-making.

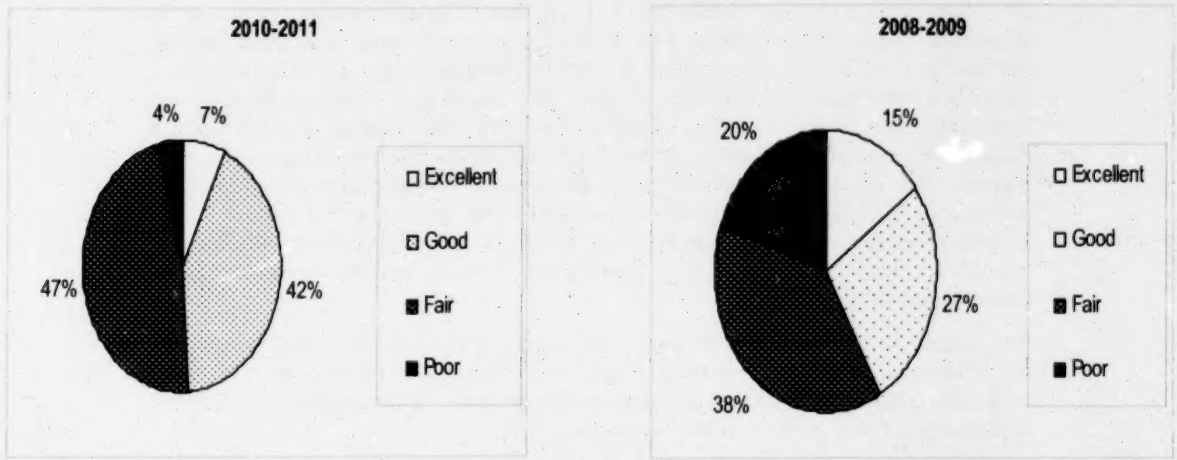
31. As shown in figure IV, there has been only marginal improvement in the quality of these reports.[22] The overall report quality rating was 2.48 in 2010-2011,

[21] See A/66/71.

[22] The 27 standards used to assess quality were developed using numerous sources, primarily UNEG norms and standards. Quality assurance mechanisms used to ensure quality were not accessed.

compared with 2.62 in 2008-2009, based on a five-point scale in which 1 means "excellent" and 5 means "very poor". There was some general correlation between evaluation resources and evaluation quality. For example, the programme with the largest amount of evaluation resources received the highest overall quality score.

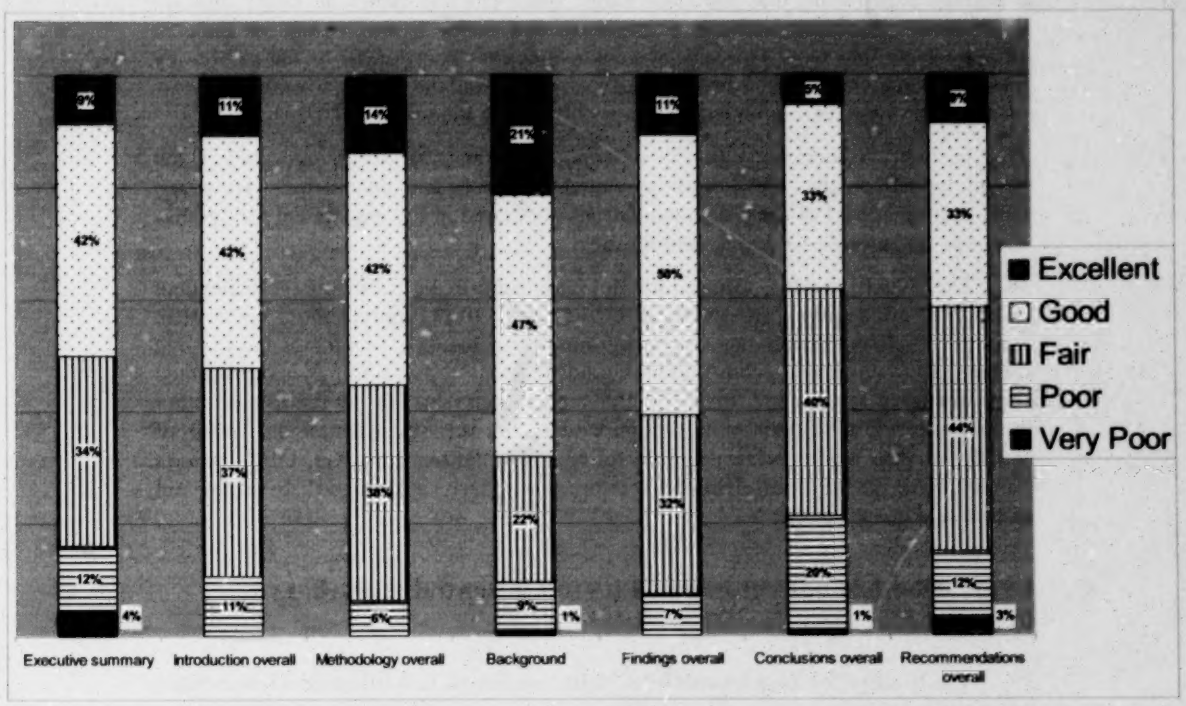
Figure IV
**Overall evaluation quality, 2008-2011**




*Source*: OIOS assessment of the quality of Secretariat evaluation reports. No evaluation reports were rated "very poor" overall.

32. With respect to the various sections of evaluation reports, some were rated higher than others, as shown in table 3. The overall assessment of the "Background" section of evaluation reports was the highest, with 68 per cent rated "excellent" or "good", while the "Conclusions" section received the lowest overall rating, with only 38 per cent rated "excellent" or "good" across the Secretariat.

Figure V
**Quality ratings by report section, 2010-2011**




*Source*: OIOS assessment of the quality of Secretariat evaluation reports.

33. In their "Introduction" section, more than over 80 per cent of the reports directly introduced the subject and 60 per cent clearly stated the purpose and objective of the evaluation. Fewer reports (approximately half) had a clearly and adequately defined scope and set out clear criteria and questions to be addressed in the report.

34. With regard to evaluation methodologies, the majority of the reports (60 per cent) presented them in a convincing manner, adequately describing data sources and analyses. As for the rigour of the evaluation design, just over one half (52 per cent) of reports were rated highly for containing appropriate and adequate evaluation criteria and questions. In contrast, descriptions of methodological limitations and evaluation validity received the lowest overall score, with a quarter of the reports rated as "poor" or "very poor" in terms of those two criteria.

35. With regard to evaluation results, most reports (75 per cent) presented them clearly and objectively, with a majority (56 per cent) presenting sufficient evidence to support them. In those reports rated more poorly on evaluation results, the main weaknesses identified were that they were presented in too narrative a style, were supported with weak evidence and were not adequately synthesized. In these reports, key findings were not clearly stated, enabling and constraining factors were not given sufficient attention, and opinions were inappropriately included among findings.

36. With regard to the "Conclusions" section of evaluation reports, the majority of the reports contained conclusions based on findings, but less than 40 per cent contained conclusions that addressed larger questions and issues or added value to the reports; these conclusions primarily reiterated the evaluation results, at times in an almost random way. The lack of conclusions that contributed to the reports by presenting analysis and interpretation of the results was the largest overall weakness identified among Secretariat evaluation reports in the biennium 2010-2011.

37. In their "Recommendations" section, three quarters of the reports set out recommendations that were directly related to results and conclusions. However, more than one third of the recommendations contained in the reports did not specify who was responsible for implementing them.

38. The overall quality ratings did not vary significantly between independent OIOS evaluations and programme self-evaluations. OIOS reports scored higher than reports of other programmes on background, conclusions, recommendations and format. OIOS conclusions built upon and added value to the findings and presented an evaluator's view more than did the conclusions set out in reports of other programmes. OIOS evaluation recommendations were also better in terms of specifying who would be responsible for implementation. However, OIOS reports scored lower on the "Introduction" section, particularly with regard to setting out criteria and questions.

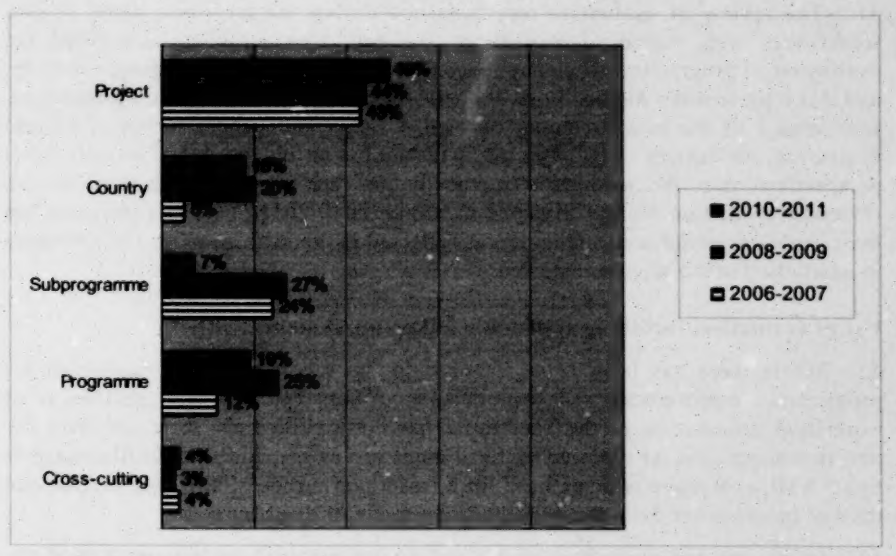
## C. Evaluation has not yet reached its full potential with regard to utility

39. A utilization-focused approach to evaluation is one that fosters evidence-based decision-making and strategic planning, enhances the usefulness of evaluation results and recommendations and generates relevant and timely products. Evaluation must be utility-focused in order to facilitate stakeholder ownership. By focusing on the information needs of intended users, evaluations can enhance the building of robust evidence to support a knowledge platform for policy advice and the replication of innovative initiatives.

### Most evaluations conducted in 2010-2011 were at the project level, but placed a greater focus on outcomes

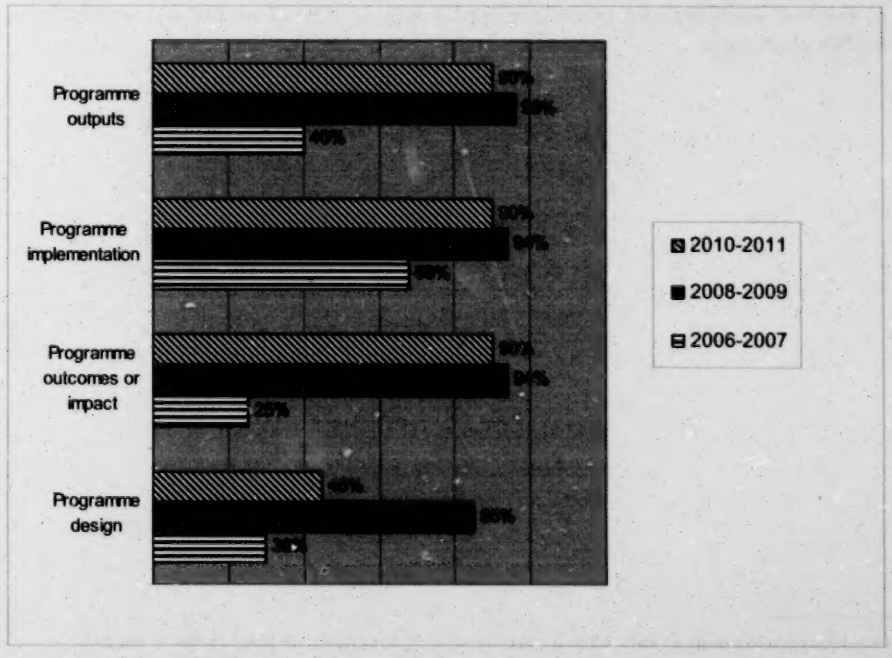
40. Figures VI and VII compare evaluations conducted within the Secretariat over the past three bienniums in terms of scope and focus. The overall scope of evaluation in the Secretariat remains primarily at the discrete project level, and cross-cutting evaluations are still relatively infrequent. It is encouraging that there continues to be a positive trend towards an increased focus on programme implementation and outcomes, with more than 90 per cent of the evaluations conducted during the past two bienniums focusing on those criteria, a significant increase compared with the biennium 2006-2007. This trend speaks positively about the potential for greater evaluation utility.

Figure VI
**Scope of evaluations as reported by Secretariat focal points, 2006-2011**




*Source*: OIOS biennial focal point surveys.

Figure VII
**Focus of evaluations as reported by Secretariat focal points, 2006-2011**




*Source*: OIOS biennial focal point surveys.

**Evaluations placed little focus on efficiency, and gender and human rights were not well integrated**

41. The review of evaluation reports issued during the biennium noted several weaknesses with regard to evaluation coverage. One weakness concerned the evaluation of programme efficiency: very few reports did this in a rigorous manner, and this represented a methodological challenge across the Secretariat. Furthermore, with regard to the mainstreaming of human rights and gender perspectives into evaluation, the former is still lacking, with almost no integration of human rights perspectives into the evaluation methodologies and findings presented in the reviewed evaluation reports from the biennium 2010-2011.[23] Greater progress has been made on gender mainstreaming, as reflected in the evaluation results contained in nearly half of the reports reviewed.

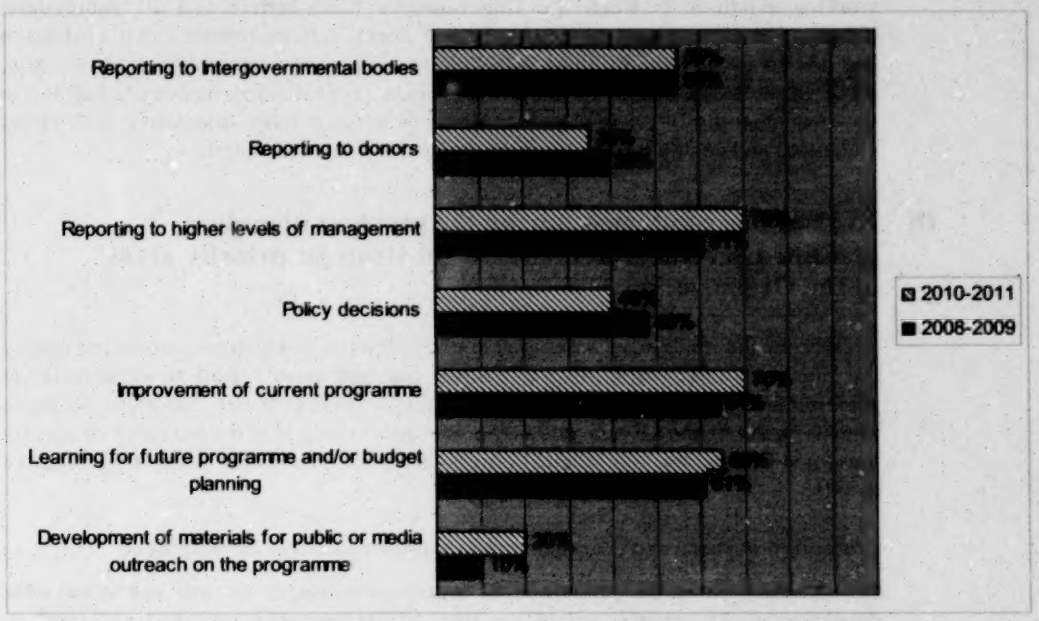
**Use of evaluation, including systematic follow-up, remains limited**

42. While there has been some increase in the reported use of evaluation for programme improvement and senior management reporting, the utilization of evaluation information in the Secretariat has not significantly increased over the past two bienniums. As reported by focal point survey respondents and illustrated in figure VIII, evaluation is being used for a variety of purposes; however, at least one third of programmes did not use evaluation for any of those purposes.

43. Interviews and workshops with focal points explored the reasons behind the limited use of evaluation. As previously noted with regard to the lack of a robust evaluation culture, those reasons included poor management buy-in, limited resources, a lack of dedicated evaluation capacity and an attitude among managers that evaluation is a burden rather than a value-added activity. Focal points referred to the low visibility and consistent application of UNEG norms and standards as further challenges.

[23] Gender mainstreaming is called for by the General Assembly in its resolutions in 50/203 (para. 3) and 53/120 (paras. 6 and 8). Human rights mainstreaming is called for in A/51/950 (paras. 78 and 79).

Figure VIII
**Uses of evaluations as reported by Secretariat focal points, 2008-2011**


Reporting to intergovernmental bodies
Reporting to donors
Reporting to higher levels of management
Policy decisions
Improvement of current programme
Learning for future programme and/or budget planning
Development of materials for public or media outreach on the programme
2010-2011
2008-2009

*Source*: OIOS biennial focal point surveys. Data for 2006-2007 were not available.

44. Timely follow-up to evaluations through the implementation of recommendations is a critical component of the use of evaluation for accountability, and such follow-up is not being carried out consistently across the Secretariat. As shown in figure III, less than half of focal point survey respondents (48 per cent) reported that their entities had developed an action plan for the implementation of evaluation recommendations, with only 39 per cent indicating that they carried out formal tracking/monitoring of the implementation of recommendations set out in the biennial evaluation plan.

45. The sharing of evaluation results is another critical component of the use of evaluation for learning. As shown in figure III, this also remains a weak area in the utilization of evaluations in the Secretariat. Only 45 per cent of focal point survey respondents reported formal procedures for the sharing and dissemination of evaluation reports, with 42 per cent reporting procedures for the sharing and dissemination of lessons learned from evaluations.

46. Focal point survey respondents cited specific examples of the ways in which evaluation had made a difference in their entities, indicating the potential of evaluation for the strengthening of programme performance. UN-Women and the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) reported that evaluations had enhanced their strategic framework planning; UN-Women also reported that an evaluability assessment of the strategic plan of the former United Nations Development Fund for Women (UNIFEM) had been used to inform the development of the UN-Women strategic plan for 2011-2013 by indicating main areas for strengthening management, including the

improvement of management efficiency. Furthermore, an evaluation of the Economic and Social Commission for Asia and the Pacific (ESCAP) fostered closer working relations between the Commission's headquarters and its subregional offices. The Department of Economic and Social Affairs reported that evaluation had led to improvements in terms of service delivery and customer satisfaction, while in the Department of Public Information, an evaluation reportedly had led to the strengthening of an important website to make it more interactive with target audiences and enable it to better meet the needs of key stakeholders.

## D. Evaluations conducted during the previous biennium identified several issues in the eight strategic priority areas of the Organization

47. From the qualitative assessments of Secretariat evaluations conducted during the biennium 2010-2011, several themes emerged with regard to organizational performance. These are discussed individually below under the eight strategic priority areas of the Organization.[24] It is worth noting that the majority of reports presented largely positive evaluation results, with only a few presenting negative results.

### Promotion of sustained economic growth and sustainable development

48. In the area of the promotion of sustained economic growth and sustainable development, 26 reports, out of the total of 60 reviewed, received a "good" or "excellent" quality rating and were analysed in terms of their content. This category comprised the largest number of reports. Of these 26, the majority (20), presented largely positive results.

49. Most of these reports provided detailed results at the project level and were therefore limited with regard to Organization-wide, cross-cutting conclusions about ways in which the Secretariat was promoting sustained economic growth and sustainable development. Key points emerging from these evaluations included the following:

(a) The Organization had positively influenced policy discussions, decision-making and policy implementation;

(b) Relevance and competitiveness had been lost to younger and better-resourced regional and international organizations, including other United Nations agencies;

(c) The Organization provided an effective framework for regional cooperation and could help to shape institutional requirements over the long term;

(d) Tools in the area of trade improved decision-making, services and the design of trade policies in developing countries;

(e) The Organization was effectively functioning as a development research office, but had had limited success in directly influencing intergovernmental debates;

[24] The eight areas are identified in General Assembly resolution 63/247.

(f) The World Urban Forum had become the world's premier platform for urban development practitioners, policymakers, national and local governments, non-governmental actors, researchers and youth and women's groups to discuss urban issues;

(g) In the areas of water and sanitation, the Organization had achieved significant results as a social and technical model tester and service provider at the community and municipal levels.

**Effective coordination of humanitarian assistance efforts**

50. In the area of the effective coordination of humanitarian assistance efforts, 14 reports received a "good" or "excellent" quality rating and were analysed in terms of their content. Of these, the majority (9) presented largely mixed results. Key points emerging from these evaluations included the following:

(a) United Nations humanitarian coordination work had resulted in better-defined roles and responsibilities in humanitarian responses and, in some cases, stronger humanitarian partners;

(b) In some cases, humanitarian assistance that had been delivered was insufficiently accessible to all affected populations, in particular families headed by women;

(c) Effective financial mechanisms were generally available for the timely delivery of assistance, especially in initial emergency phases;

(d) Weaknesses of United Nations humanitarian work included poor needs assessments and gaps between relief efforts and recovery work, limiting the long-term impacts of the interventions.

**Drug control, crime prevention and combating international terrorism**

51. In the area of drug control, crime prevention and combating international terrorism, seven reports received a "good" or "excellent" quality rating and were analysed in terms of their content. Of these, the majority (five) presented largely positive results. All of the reports in this category were received from the United Nations Office on Drugs and Crime. Key points emerging from these evaluations included the following:

(a) The Organization had increased the understanding of local administrations with respect to drug use prevention;

(b) HIV/AIDS prevention programmes had been effective in working with HIV-positive inmates and former detainees;

(c) The Organization had successfully promoted the adoption of national legislation and the establishment of law enforcement institutions and procedures through its mentoring and information support systems.

**Maintenance of international peace and security**

52. In the area of the maintenance of international peace and security, five reports received a "good" or "excellent" quality rating and were analysed in terms of their content. Of these, the majority (four) presented largely mixed results. Key points emerging from these evaluations included the following:

(a) A successful framework had been established for addressing conduct and discipline issues, in response to requests from peacekeeping missions;

(b) There had been an increased number of responses to missions requesting assistance in the monitoring, review and finalization of disciplinary cases, but this had come at the expense of strategic guidance, policy development and the application of procedural standards across missions;

(c) Limited progress had been made in terms of workforce planning, and new initiatives were only slowly reducing vacancy rates at United Nations peacekeeping missions;

(d) The training of both field and Headquarters staff on United Nations entitlements and rules regarding conditions of service was inadequate;

(e) Communication and collaboration between different peacekeeping services and sections was insufficient.

**Development of Africa**

53. In the area of the development of Africa, five reports received a "good" or "excellent" quality rating and were analysed in terms of their content. Of these, the majority (four) presented largely mixed results. Key points emerging from these evaluations included the following:

(a) There were significant issues affecting women in Africa;

(b) Successes had been achieved in Kenya regarding support for gender gains and the protection of human rights in the new Constitution;

(c) A regional network for women in South Africa on law and governance, HIV/AIDS and information and communications technology had had mixed results;

(d) Initiatives to end violence in the Central African subregion had strengthened national legal and policy frameworks and contributed to the development and adoption of a national strategy for combating gender-based violence.

**Promotion of human rights**

54. In the area of the promotion of human rights, only one programme, UN-Women, submitted reports, and those two reports received a "good" or "excellent" quality rating. One report presented largely positive results, whereas the other presented mixed results. Given that all programmes are mandated to mainstream human rights into work programmes, the small number of reports received implies a lack of evaluative evidence on how effectively the Organization is promoting human rights. The two reports indicated that:

(a) Crucial strides had been achieved regarding awareness-raising and advocacy on human rights and gender-based violence through partnerships with civil society organizations, religious leaders and police in the Sudan and Iraq;

(b) A campaign promoting gender equality in the legislative process in Iraq had encouraged women to vote and had been reflected in the larger turnout by women voters in the 2010 constitutional referendum.

**Disarmament**

55. In the area of disarmament, one report was received, and it presented mixed results.[25] The report indicated that

> not all scheduled disarmament, demobilization and reintegration activities had taken place according to plan during the first disarmament, demobilization and reintegration process, from 2004 to 2008 in Burundi; however, the second process, from 2009 to 2011, had been more favourable.

**Promotion of justice and international law**

56. No evaluation reports were received in the area of the promotion of justice and international law, despite the fact that it is one of the Secretary-General's eight main priority areas. Thus, there is a lack of evaluative evidence on how the Organization is performing in this area.

## IV. Evaluation workplan of the Office of Internal Oversight Services

57. In order to establish regular budget evaluation priorities, OIOS utilized a systematic, strategic risk-based planning approach introduced in 2007, incorporating 12 proxy risk indicators.[26] It has also used a risk-based planning approach in its peacekeeping evaluations.

58. Since the beginning of 2008, OIOS has completed the following evaluations:

Entity evaluations:

- 2008: Department of Political Affairs (one summary and five subprogramme reports), Office of Human Resources Management, Peacebuilding Support Office
- 2009: Office of the United Nations High Commissioner for Human Rights, Office of the Special Adviser on Africa, Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, Department for General Assembly and Conference Management (integrated global management), United Nations Operation in Côte d'Ivoire
- 2010: Department of Management (six subprogramme reports), UNRWA, United Nations Mission in Liberia
- 2011: Department of Economic and Social Affairs (1 summary and 10 subprogramme reports), United Nations Mission in the Sudan
- 2012: United Nations Stabilization Mission in Haiti

Thematic evaluations:

- 2008: review of results-based management

[25] The Department of Peacekeeping Operations submitted this report.

[26] The biennial report issued on 26 February 2009 (A/64/63) presented the OIOS risk-based approach in detail.

- 2009: coordinating bodies; lessons learned: protocols and practices, Environment Management Group
- 2010: gender mainstreaming in the United Nations Secretariat; United Nations Secretariat business partnerships addressing climate change
- 2011: Department of Peacekeeping Operations/Department of Field Support cooperation with regional organizations; review of the organizational framework of the public information function of the Secretariat

59. By the end of 2013, the following evaluations will have been completed:

- Office for the Coordination of Humanitarian Affairs
- UNEP
- United Nations Office on Drugs and Crime
- ECA
- Review of the evaluation capacity of the Office of the United Nations High Commissioner for Refugees
- Flexibility and adaptability in United Nations Interim Force in Lebanon peacekeeping
- Measures used by peacekeeping missions to report progress on the protection of citizens

60. In the previous biennial report (A/66/71), OIOS proposed that all Secretariat programmes be evaluated according to a 12-year cycle. The General Assembly, in its resolution 65/244, approved the reduction of that cycle to every eight years, and OIOS proposes that a phased approach be taken to achieving this. During the biennium 2014-2015, OIOS will complete evaluations of critical management and strategic areas for the following entities:[27]

- Department of Peacekeeping Operations/Department of Field Support (Headquarters)
- Department of Safety and Security
- ESCAP
- The United Nations Human Settlements Programme
- The Economic Commission for Latin America and the Caribbean
- The United Nations Conference on Trade and Development
- The International Trade Centre
- UN-Women

[27] The previous biennial study (see A/66/71) identified the United Nations Conference on Trade and Development, the Department for General Assembly and Conference Management and the Office for Disarmament Affairs for evaluation in 2014-2015; however, owing to a more recent risk assessment, those entities have been replaced by the Department of Peacekeeping Operations (Headquarters), ESCAP and the United Nations Human Settlements Programme.

It will also complete thematic evaluations on the following topics:

- Monitoring and evaluation of the Millennium Development Goals: lessons learned
- Sexual exploitation and abuse in peacekeeping missions
- Peacekeeping: protection of civilians
- Peacekeeping: standing police force

In addition, it will complete an evaluability assessment on the administration of justice.

61. The Committee for Programme and Coordination may consider which evaluations relating to the aforementioned 2014-2015 workplan it would like to review at its fifty-fourth session, in 2015, and request OIOS to undertake any additional evaluations not included in its current workplan.

## V. Follow-up on the recommended actions of the Committee for Programme and Coordination

62. In the previous biennial study, OIOS committed to two actions to support improvements in the quality of evaluation in the Secretariat. First, the Office shared detailed evaluation report quality assessments with all programmes in August 2011; it intends to do the same with respect to the reports assessed for this biennial study. Secondly, OIOS shared a report template for high-quality evaluations.

63. In the previous biennial study, the Committee for Programme and Coordination recommended that the General Assembly request the Secretary-General to ensure that OIOS evaluation reports also focus on programme impact and results achieved, by improving the methodology for conducting assessments and, in particular, ensuring regular follow-up on the progress made and more comprehensive conclusions.[28] OIOS has taken several actions in response to this recommendation, including:

(a) Greater use of quantitative data;

(b) More rigorous follow-up with entities being evaluated to discuss feasible recommendations and action plans for their implementation, including the sharing of additional information that may be useful for programmes as they seek to improve their performance.

64. More recently, the following initiatives have been introduced:

(a) The development of programme impact pathways to establish a theory of change for all programmes being evaluated and to provide an evaluative framework for determining the strategic evaluation questions to be addressed;

(b) Enhanced scoping at the beginning of all evaluations, undertaken in consultation with the entities being assessed, to ensure that evaluation designs are

[28] A/66/16, para 62. This recommendation was subsequently endorsed by the General Assembly in its resolution 66/8.

appropriate for answering the key questions and that the evaluation will add value in terms of decision-making, accountability and learning;

(c) Plans to enhance the methodology for upcoming triennial reviews to ensure that they focus not only on the implementation of recommendations but also on reasons for non-implementation and further analysis of remaining issues.

65. The Committee also recommended that the General Assembly request the Secretary-General to ensure that a more systematic approach to evaluating activities is adopted by OIOS, including in terms of the better exploitation of complementarities and synergies among all activities and of the strengthening of coordination among all relevant departments.[29] OIOS responded to this recommendation by:

(a) Revisiting its risk assessment methodology for determining the evaluation workplan, particularly with regard to cross-cutting thematic evaluations focusing on programme coordination and synergies;

(b) Undertaking a more collaborative approach with Secretariat programmes, in particular the Department of Peacekeeping Operations/Department of Field Support, with which work planning is continuous, when finalizing its workplan to ensure that OIOS evaluations are more responsive to information needs and assessment gaps;

(c) Enhancing coordination with the Joint Inspection Unit and the Board of Auditors in finalizing its workplan;

(d) Participating as a reference group member with respect to initiatives to establish a system-wide evaluation mechanism.

## VI. Conclusions

66. The General Assembly, in its resolution 67/226, emphasized the importance of having independent, credible and useful evaluation functions, with sufficient resources, and a culture of evaluation that ensures the active use of evaluation findings and recommendations in policy development and improving the functioning of the organizations of the United Nations. This objective has not yet been reached in the Secretariat, where evaluation has yet to become a fully robust and comprehensive function that is integral to how a programme works. Given the critical issues facing the Organization, it is imperative that evidence-based evaluation on programme performance guide the design and implementation of programmes.

67. When conducted in a credible and reliable manner, evaluation has the potential to feed into strategic decision-making to guide the future of the Organization. In this regard, it is an underutilized resource.

68. In resolution 67/226, the General Assembly noted the development of UNEG norms and standards for evaluation and encouraged their use in the evaluation functions of United Nations funds, programmes and specialized agencies, as well as in system-wide evaluations of operational activities for development. Measured in terms of these norms and standards, evaluation in the Secretariat contains critical

[29] A/66/16, para. 63. This recommendation was subsequently endorsed by the General Assembly in its resolution 66/8.

gaps that need to be addressed if it is to flourish. These include the need for more financial and human resources, more robust evaluation policies, strengthened operational independence on the part of evaluation units, enhanced senior management support and buy-in, stronger evaluation competencies among staff responsible for evaluation, more regular and systematic procedures for the planning, conduct and follow-up of evaluation, and a more vigorous evaluation culture.

69. There is also a clear need for more support and guidance for self-evaluation. While OIOS has a role to play in providing guidance and methodological advice, it is not appropriate for the Office to directly develop capacity for evaluation within Secretariat programmes or to ensure that programmes are equipped with the competencies necessary to undertake credible evaluation. Those functions are more appropriately placed within the programmes themselves, as it is the responsibility of programme managers to ensure that their staff have the competencies necessary to carry out all relevant functions, including self-evaluation. OIOS can provide guidance and support to programmes in the conduct of self-evaluation, including methodological advice. Examples of this have included providing advice on evaluation design, data collection and analysis, and inviting evaluation colleagues to evaluation seminars of the Inspection and Evaluation Division. Currently, no unit dedicated to supporting self-evaluation exists in the Secretariat.

70. OIOS welcomes any recommendations from Member States on how to strengthen this critical evaluation function.

# Annex I

## List of departments and offices included in the biennial study

1. Department of Economic and Social Affairs
2. Department of Field Support
3. Department for General Assembly and Conference Management
4. Department of Management
5. Department of Political Affairs
6. Department of Public Information
7. Department of Peacekeeping Operations
8. Department of Safety and Security
9. Economic Commission for Africa
10. Economic Commission for Europe
11. Economic Commission for Latin America and the Caribbean
12. Executive Office of the Secretary-General
13. Economic and Social Commission for Asia and the Pacific
14. Economic and Social Commission for Western Asia
15. International Trade Centre UNCTAD/WTO
16. Office for the Coordination of Humanitarian Affairs
17. Office for Disarmament Affairs
18. Office of the United Nations High Commissioner for Human Rights
19. Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States
20. Office of Internal Oversight Services
21. Office of Legal Affairs
22. Office for Outer Space Affairs
23. Office of the Special Adviser on Africa
24. United Nations Conference on Trade and Development
25. United Nations Environment Programme
26. United Nations Human Settlements Programme
27. Office of the United Nations High Commissioner for Refugees
28. United Nations Office on Drugs and Crime
29. United Nations Relief and Works Agency for Palestine Refugees in the Near East

30. United Nations Office at Geneva
31. United Nations Office at Nairobi
32. United Nations Office at Vienna
33. United Nations Entity for Gender Equality and the Empowerment of Women

# Annex II

## Methodology for the review of evaluation reports

In identifying 2010-2011 evaluation reports, the Office of Internal Oversight Services (OIOS) requested all focal points to submit reports finalized in 2010 or 2011 and used programme websites to identify reports. OIOS received a total of 298 reports, representing 28 Secretariat entities. Six entities had no available evaluation reports for the biennium: the Department of Management, the Office of Legal Affairs, the Office for Outer Space Affairs, the Office of the Special Adviser on Africa, the United Nations Office at Vienna and the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States. Eleven evaluations that had been conducted in languages other than English or had been conducted by donor agencies were excluded from the review.

OIOS reviewed the 298 reports to verify that they met the OIOS operational definition of evaluation.[a] A total of 153 were determined to be evaluation reports. None of the reports submitted by the following 10 entities passed the OIOS screening: the Executive Office of the Secretary-General, the Department for General Assembly and Conference Management, the Department of Political Affairs, the Department of Public Information, the Department of Safety and Security, the Economic Commission for Africa, the Economic Commission for Europe, the Office for Disarmament Affairs, the United Nations Office at Geneva and United Nations Office at Nairobi.[b]

From among the 153 evaluation reports, a two-tier purposive sampling of 94 reports was conducted for further assessment. All reports from entities submitting 10 or fewer reports were included in the sample. From among the reports of entities submitting more than 10 reports, a further purposive sample was drawn using the following criteria:

(a) A balance of reports from each biennium year;

(b) A balance in midterm and final evaluations;

(c) A mix of project, subprogramme, thematic and external evaluations;

(d) A balance of different topics and themes;

(e) Widespread geographical coverage.

All 94 reports in the sample were assessed to determine the following attributes:

(a) Quality;

(b) Focus;

(c) Scope.

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[a] OIOS has defined evaluation as "a systematic and discrete process, as objective as possible, to determine the relevance, efficiency, effectiveness, impact, and/or sustainability of any element of a programme's performance relative to its mandate or goals".

[b] Some entities submitted reports that passed the OIOS screening but had not been finalized during the biennium 2010-2011.

The quality assessment used 27 standards. Several report sections were assessed to ascertain quality, including executive summary, introduction, methodology, background, findings, conclusions, recommendations, annexes and format. In order to ensure that the quality assessment was as impartial as possible, OIOS contracted with an independent evaluation expert for its conduct.

In addition, the 64 reports assessed to be of "excellent" or "good" quality were categorized under one of the eight strategic priority areas of the Organization and assessed to determine key results and conclusions:

(a) Maintenance of international peace and security;

(b) Disarmament;

(c) Development of Africa;

(d) Promotion of human rights;

(e) Promotion of sustained economic growth and sustainable development;

(f) Effective coordination of humanitarian assistance efforts;

(g) Promotion of justice and international law;

(h) Drug control, crime prevention and combating international terrorism.

# Annex III

## Comments received from Secretariat entities on the draft report[a]

### Department of Economic and Social Affairs

Paragraph 18 of the report states that the lack of a dedicated unit for evaluation in programmes with significant operational activities and mandates, such as the Department of Political Affairs and the Department of Economic and Social Affairs, is of serious concern. The Office of Internal Oversight Services (OIOS) will provide further information and suggestions regarding how to fill this gap in the forthcoming evaluation scorecards. This paragraph was added to the report after the informal draft of the report had been shared by OIOS for comments. The Department looks forward to receiving further information and suggestions from OIOS, especially with regard to the mandate and resources for the establishment of a dedicated evaluation unit. In 2011, the Department set up a departmental network of evaluation focal points that facilitates programme monitoring and evaluation in the Department. The network undertook several training activities. It also contributed to the finalization of the Department's evaluation policy in June 2012.

### Department of Field Support

See Department of Peacekeeping Operations.

### Department for General Assembly and Conference Management

The Department for General Assembly and Conference Management welcomes the report and is greatly appreciative of the effort by OIOS and of the quality and breadth of coverage of the report.

Further, the Department would like to point out that, given its mandate, it is particularly interested in developing an evaluation framework, together with related policies and integrated tools, that would respond to the inclusion of persons with disabilities in United Nations meetings. A comprehensive evaluation framework will be developed to engage various duty stations in a policy of inclusion and, through them, host countries as they prepare to host international meetings and conferences of the United Nations towards the delivery of the commitments to human rights instruments such as the Convention on the Rights of Persons with Disabilities.

The framework will be designed on the basis of lessons learned by the Department in successfully delivering the United Nations Conference on Sustainable Development, for which the Secretariat developed accessibility guidelines to support the Desktop Publishing Unit in publishing in an advisory capacity, including policies, guidelines, implementation and introductions to

[a] The inclusion of this information is in line with General Assembly resolution 64/263, pursuant to the recommendation of the Independent Audit Advisory Committee. The comments on the draft report of the Office of Internal Oversight Services have been incorporated, as appropriate, into the final report.

working and testing tools. The Integrated Sustainable PaperSmart Services Portal was made accessible in accordance with the Web Content Accessibility Guidelines 2.0 under the Web Accessibility Initiative. Accessibility identifiers were used to identify accessible documents. Working closely with the Government of Brazil, as the host country, the Department facilitated the use of sign language (Libras) and communication access real-time translation.

## Department of Peacekeeping Operations

### Methodology

*Paragraph 9*

1. The Department of Peacekeeping Operations requests that OIOS specify the multiple sources of data used in triangulation.

### Use of evaluation, including systematic follow-up, remains limited

*Paragraph 47*

2. We request that the last sentence in paragraph 47, on the quality of the Secretariat evaluations, be deleted, as it seems to be a subjective opinion without supporting data.

### Disarmament

*Paragraph 55*

3. We request that the heading above paragraph 55 be reworded to read "Disarmament, demobilization and reintegration" instead of "Disarmament" and that the word "only" be removed from the first line of the paragraph, as it stands in contrast to the otherwise factual character of the paragraph.

4. We request that part of paragraph 55 be reworded to read: "not all scheduled activities had taken place according to plan during the first disarmament, demobilization and reintegration process, from 2004 to 2008, in Burundi; however, the second process, from 2009 to 2011, had been more favourable".

5. We also request that paragraph 55 be cross-referenced to the following report, on which it is based, by means of a footnote: "*Expanded After Action Review: Disarmament, Demobilization and Reintegration in Burundi, 2000-2011*. A retrospective overview of successive DDR processes in Burundi, an impact assessment of program outcomes, and a strategic analysis of institutional partnerships."

## Economic and Social Commission for Western Asia

1. The report is clear and well supported in its strategic message: there are successful cases of evaluation exercises to build on in order to overcome the general deficiency from which we suffer, especially in collecting and documenting evidence on the results, outcome and impact of our activities Secretariat-wide. It is a message that we will take to heart.

2. At the Economic and Social Commission for Western Asia (ESCWA), we find that our experience is largely in line with the draft report's overall assessments:

(a) Improving the quality and usefulness of evaluation is a priority;

(b) There is a need to increase the funds allocated to evaluation, which are insufficient (at ESCWA, the share of the budget allocated to evaluation has in fact risen from approximately 0.7 per cent to 1.1 per cent (see figure I));

(c) There is a need to emphasize the complementarity of and distinctions between the functions of monitoring and evaluation;

(d) Self-evaluation is undersupported by the Secretariat;

(e) There is a need to establish a clearer link among good management, results-based management and the strengthening of evaluation activities;

(f) There is a need for strong follow-up to translate evaluation recommendations into actionable management improvement opportunities.

3. In addition to the overall diagnoses and suggestions of the draft report, we have noted the data specific to ESCWA and have no changes to suggest. With respect to the work programme, ESCWA is not on your upcoming schedule. We are sure that this is linked to the eight-year cycle. We at ESCWA will look forward to an opportunity to work with OIOS on an external evaluation of our programme.

## Office for the Coordination of Humanitarian Affairs

The Office for the Coordination of Humanitarian Affairs welcomes the findings of this report and the identification of areas in which evaluation capacity across the Secretariat may be strengthened. The Office has provided comments on the informal report and has no additional comments or concerns to raise at this time.

## United Nations Human Settlements Programme

The report is very useful and timely, given the current debate among United Nations entities, development partners and Member States on strengthening the role of evaluation. The United Nations Human Settlements Programme (UN-Habitat) supports the findings, conclusions and recommendations of the draft report.

UN-Habitat has made significant progress in strengthening its evaluation function. In February 2012, we established an independent Evaluation Unit to further strengthen the evaluation function, and in January 2013 we approved the UN-Habitat Evaluation Policy. The Policy gives us an institutional framework for UN-Habitat evaluations, strengthens systematic learning from the work of UN-Habitat and helps to credibly document the effectiveness of our programmes and projects.

The draft reveals that the ambition of having a culture of evaluation that ensures an independent, credible and useful evaluation function has not yet been attained in the United Nations Secretariat. It points out the inadequacy of the existing evaluation capacity and insufficient evaluation resources. In UN-Habitat, as in other United Nations agencies, we are faced with the challenge of managing the expectations of evaluation with limited financial and human resources, and we would welcome your views and suggestions on this fundamental challenge.

UN-Habitat is committed to further strengthening its evaluation function, creating an evaluation culture and improving performance and effectiveness in this area. In that regard, we look forward to the evaluation of UN-Habitat by OIOS in the biennium 2014-2015 on critical management and strategic issues.

## United Nations Entity for Gender Equality and the Empowerment of Women

The Evaluation Office of the United Nations Entity for Gender Equality and the Empowerment of Women (UN-Women) would like to express thanks to OIOS for this report, which provides a strong case for strengthening evaluation in the Secretariat. The analysis regarding the trends in evaluation design, process and reports was very informative. UN-Women is happy to note the increase in the number of focal points that reported that they are integrating gender and human rights into evaluation design and process. However, as the report indicates, the Secretariat still has a lot of work to do to ensure that gender and human rights are incorporated into evaluation adequately. In this regard, we would like to note that the Evaluation Office has a role in supporting the coordination and reporting of progress made in fulfilling the commitments of the United Nations system on gender equality and the empowerment of women, including document CEB2006/2 and the associated United Nations system-wide action plan. The Evaluation Office is supporting compliance with and reporting on the plan's evaluation performance indicator. During 2012, UN-Women developed a tool for aligning and harmonizing United Nations system reporting with the evaluation performance indicator, and supported the refinement of the associated technical notes. The Evaluation Office coordinated the review of both products by the United Nations Evaluation Group (UNEG) Human Rights and Gender Equality Task Force and will seek endorsement of the revised technical notes and reporting tool by UNEG in the upcoming UNEG annual general meeting 2013. This tool will enable systematic reporting across the United Nations system on the integration of gender equality into evaluation. In terms of building an organizational culture that is supportive of evaluation, we fully agree that it is critical to ensure senior management buy-in to ensure that evaluation is utilized to its fullest potential, as a tool for enhancing the work of the Organization and achieving results for gender equality and women's empowerment. Sufficient financial and human resources are also necessary for an evaluation function to cover the entire programme of work of an entity. The Evaluation Office also believes that it is critical to build effective planning, monitoring and reporting systems that will enable the evaluation function to provide the most useful information possible and contribute to evidence-based programming.

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**Oceans and the law of the sea**

# Oceans and the law of the sea

## Report of the Secretary-General

*Summary*

The present report has been prepared pursuant to paragraph 272 of General Assembly resolution 67/78, with a view to facilitating discussions on the topic of focus at the fourteenth meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea, on the theme entitled "The impacts of ocean acidification on the marine environment". It constitutes the first part of the report of the Secretary-General on developments and issues relating to ocean affairs and the law of the sea for consideration by the Assembly at its sixty-eighth session. The report is also being submitted to the States Parties to the United Nations Convention on the Law of the Sea, pursuant to article 319 of the Convention. In the light of the technical nature of the topic being covered and the page limitations required by the General Assembly, the report does not purport to provide an exhaustive synthesis of available information.

* A/68/50.

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# I. Introduction

1. In paragraph 261 of its resolution 67/78, the General Assembly decided that, in its deliberations on the report of the Secretary-General on oceans and the law of the sea, the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea ("the Informal Consultative Process") would focus its discussions at its fourteenth meeting on the impacts of ocean acidification on the marine environment. The present report addresses that topic.

2. The oceans play a critical role in the global carbon cycle, absorbing approximately one quarter of the carbon dioxide ($CO_2$) emitted to the atmosphere from the burning of fossil fuels, deforestation and other human activities. As more and more anthropogenic $CO_2$ is emitted into the atmosphere, the oceans absorb greater amounts at increasingly rapid rates. In the absence of this service by the oceans, atmospheric $CO_2$ levels would be significantly higher than at present and the effects of global climate change more marked.[1]

3. The absorption of atmospheric $CO_2$ has, however, resulted in changes to the chemical balance of the oceans, causing them to become more acidic. Ocean acidity has increased significantly, by 30 per cent, since the beginning of the Industrial Revolution 250 years ago. It is predicted that, by 2050, ocean acidity could increase by 150 per cent. This significant increase is 100 times faster than any change in acidity experienced in the marine environment over the last 20 million years, giving little time for evolutionary adaptation within biological systems.[2]

4. An emerging body of research suggests that many of the effects of ocean acidification on marine organisms and ecosystems will be variable and complex, impacting developmental and adult phases differently across species depending on genetics, pre-adaptive mechanisms, and synergistic environmental factors.[3] Ocean acidification is also expected to have significant socioeconomic impacts, particularly on communities and economic sectors dependent on the oceans and their resources.[4]

5. In the light of the potentially dramatic consequences of ocean acidification for marine ecosystems and the livelihood of people that depend on them, a wide range of intergovernmental organizations and expert groups are considering this emerging challenge.

6. Section II of the report provides information on ocean acidification and its impacts on the marine environment, including related socioeconomic impacts. Section III sets out information on the elements of the legal and policy framework that could be considered as relevant to addressing ocean acidification. Sections IV and V, respectively, attempt to identify developments at the global and regional levels, as well as challenges and opportunities in addressing the impacts of ocean acidification.

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[1] Secretariat of the Convention on Biological Diversity, Scientific Synthesis of the Impacts of Ocean Acidification on Marine Biodiversity, Technical Series No. 46 (Montreal, 2009).

[2] Ibid.

[3] Ibid.

[4] Cherie Winner, "The socioeconomic costs of ocean acidification: seawater's lower pH will affect food supplies, pocketbooks, and lifestyles", *Oceanus* (8 January 2010), available at www.whoi.edu/oceanus/viewArticle.do?id=65266.

7. The Secretary-General wishes to express his appreciation to the organizations and bodies that contributed to the present report, namely, the European Union and the secretariats of the Antarctic Treaty; the Commission for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Commission); the Convention on Biological Diversity; the Convention on the Conservation of Antarctic Marine Living Resources; the Food and Agriculture Organization of the United Nations (FAO); the General Fisheries Commission for the Mediterranean; the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO); the International Atomic Energy Agency (IAEA); the International Coral Reef Initiative (ICRI); the International Maritime Organization (IMO); the International Union for Conservation of Nature (IUCN); the North Atlantic Salmon Conservation Organization (NASCO); the Organization for Economic Cooperation and Development (OECD); the Pacific Islands Applied GeoScience Commission (SOPAC); and the United Nations Development Programme (UNDP).[5] The report also draws on information from a number of academic sources, but does not purport to provide an exhaustive synthesis of available information.

# II. Ocean acidification and its impacts

8. Ocean acidification is the phenomenon of the oceans becoming progressively less alkaline as a result of increased $CO_2$ levels in the atmosphere dissolving in the ocean. If allowed to continue unabated, this process may have significant impacts on marine ecosystems and livelihoods worldwide, as well as the carbon cycle.

## A. Ocean acidification and its causes

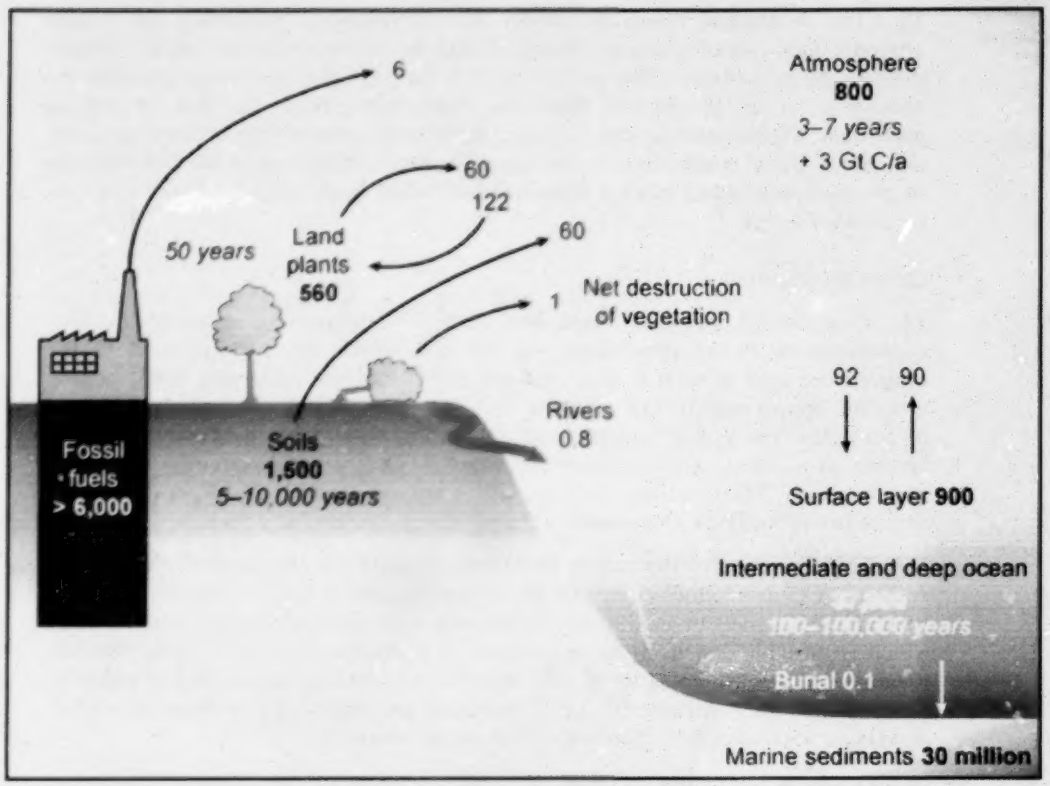
*Carbon cycle*

9. Carbon naturally exists in various chemical forms, including in fossil fuels, within plants and animals, in organic matter, in $CO_2$ and methane and in calcium carbonate. The carbon cycle consists of series of processes describing the flow of carbon throughout the environment, namely, plants and animals (biosphere), air (atmosphere), soils (pedosphere), rocks (lithosphere), and water (hydrosphere), including the movement and storage of carbon within a sphere, and the exchange of carbon between spheres.[6] The figure below illustrates the main elements of the global carbon cycle.[7]

[5] The contributions whose authors have authorized them to be posted online are available at www.un.org/Depts/los/general_assembly/general_assembly_reports.htm.

[6] *Climate Change 2007 — The Physical Science Basis*, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge, United Kingdom, and New York: Cambridge University Press, 2007).

[7] Figure modified from *The Future Oceans — Warming Up, Rising High, Turning Sour*, German Advisory Council on Global Change, Special Report (Berlin, 2006). Values of the average carbon flux are shown in gigatons (Gt) per year of carbon; values for carbon reservoirs are shown in Gt of carbon in bold; values for mean residence times are shown in years italics.




10. The intermediate and deep oceans are the most significant reservoir of $CO_2$ and also the longest-term sink.[8] The surface layer of the ocean, however, plays a critical role in the carbon cycle, as $CO_2$ is continuously exchanged across the air-sea interface due to the difference in partial pressure of $CO_2$. As more CO2 is emitted into the atmosphere from anthropogenic activities, more $CO_2$ is dissolved in the surface layer of the ocean.[9]

11. The solubility and distribution of $CO_2$ in the ocean depends on climatic conditions, as well as a number of physical (e.g., water column mixing, temperature), chemical (e.g., carbonate chemistry) and biological (e.g., biological productivity) factors. Once $CO_2$ is absorbed in the surface waters, it is transported horizontally and vertically throughout the ocean by two basic mechanisms: the "solubility pump" and the "biological pump".

12. The solubility pump reflects the temperature dependence of the solubility of $CO_2$, which is more soluble in colder water, and the thermal stratification of the ocean. Large-scale circulation of ocean water is driven by colder, saltier, denser water sinking at high latitudes into deep ocean basins and transporting carbon to be later released by wind and topography-driven upwelling. Depending on the location and ocean currents, $CO_2$ can be retained in deep waters for up to 1,000 years.

[8] Ibid.

[9] Since 1750, the concentration of carbon dioxide in the atmosphere has risen from a relatively stable range between 260 and 280 parts per million (ppm) to about 390 ppm in 2009.

13. The biological pump is driven by the primary production of marine phytoplankton, which converts dissolved carbon and nutrients into organic matter through photosynthesis. The uptake of $CO_2$ through photosynthesis prompts the absorption of additional $CO_2$ from the atmosphere, fuels the flux of sinking particulate organic carbon into the deep ocean as organisms die or are consumed, and drives global marine food webs. Approximately, 30 per cent of the $CO_2$ taken up by phytoplankton sinks into the deeper waters before being converted back into $CO_2$ by marine bacteria.[10]

*Ocean acidification*

14. Over recent decades, there has been a demonstrable increase in $CO_2$ concentrations in the upper layer of the sea, which can be attributed to the proportional rise of $CO_2$ in the atmosphere.[11] Between 1800 and 1995, oceans absorbed approximately 118 gigatons (Gt) of carbon, which corresponds to about 29 per cent of the total $CO_2$ emissions from burning fossil fuels, land use change and cement production, among other activities.[12] Oceans are currently absorbing approximately 2 Gt of carbon per year, which represents about 25-30 per cent of the annual anthropogenic $CO_2$ emissions.[13]

15. This alteration of the carbon cycle has changed the chemistry of the oceans. Although $CO_2$ is chemically neutral in the atmosphere, it is active in the oceans.[14] When $CO_2$ dissolves in seawater, it produces a weak acid known as carbonic acid, which is unstable and leads to an increase in hydrogen ions. These ions increase ocean acidity, measured as lower pH, and reduce carbonate ion saturation which is necessary for the formation of shells, skeletons and other hard surfaces in marine organisms, such as corals, shellfish and marine plankton.[15]

16. Ocean acidification is thus the phenomenon of the oceans becoming progressively less alkaline. The surface waters of the oceans are currently slightly alkaline with a mean pH of approximately 8.1. This represents a 30 per cent increase in acidity relative to the preindustrial value (pH 8.2)[16] owing to the $CO_2$ absorbed by the oceans.[17] This rate of acidification has not been experienced by marine

[10] See note 1 above.

[11] See notes 6 and 7 above.

[12] See note 1 above.

[13] Ocean Acidification Reference User Group, "Ocean acidification: the facts. A special introductory guide for policy advisers and decision makers", European Project on Ocean Acidification, 2009.

[14] See note 7 above.

[15] pH units define the alkalinity/acidity of a solution and measure the hydrogen ion concentration. A pH of 7 is neutral; higher numbers refer to alkaline, or basic solutions and lower numbers refer to acidic solutions. UNEP, UNEP Emerging Issues, "Environmental consequences of ocean acidification: a threat to food security", 2010.

[16] "Ocean acidification: a summary for policymakers from the Second Symposium on the Ocean in a High-$CO_2$ World", available at www.ocean-acidification.net; J. C. Orr and others, "Research priorities for ocean acidification", report from the Second Symposium on the Ocean in a High-$CO_2$ World, Monaco, 6-9 October 2008 (2009), available at www.ocean-acidification.net.

[17] See notes 1 and 15 above.

organisms for many millions of years.[18] Carbonate ion concentrations are now lower than at any other time during the last 800,000 years.[19]

17. Ocean acidification is caused by increased levels of atmospheric $CO_2$ dissolving in the ocean. This process is largely independent of climate change, although increasing sea water temperature reduces the solubility of $CO_2$. While there remains a degree of uncertainty about the impacts that will arise as a result of climate change, which is the consequence of a suite of greenhouse gases causing the Earth to absorb more of the sun's energy, the chemical changes that are occurring in the oceans due to ocean acidification are considered to be certain and predictable.[20]

18. Across the range of emission scenarios, surface ocean pH is projected to decrease by approximately 0.4 pH units, leading to a 150-185 per cent increase in acidity by 2100, relative to preindustrial conditions.[21] Such a major change in basic ocean chemistry would have substantial implications for ocean life in the future.

19. Moreover, such changes appear long-lasting and difficult to reverse. Shoaling and subsequent dissolution of sedimentary carbonates is one of the major long-term buffering mechanisms by which the ocean's pH will be restored. This process, however, operates over millennial time scales and will be processed only as anthropogenic $CO_2$ reaches the saturation depths through ocean circulation.[22]

## B. Impacts of ocean acidification[23]

20. Continued $CO_2$ emissions are expected to pose a threat to the reproduction, growth and survival at species level and could lead to loss of biodiversity and profound ecological shifts. It is anticipated that ocean acidification will produce changes in ocean chemistry that may affect the availability of nutrients and the toxicity and speciation of trace elements to marine organisms. However, the extent of the pH-induced changes is difficult to determine. Variation in the availability of nutrients may have an indirect effect on cellular acquisition, the growth of photosynthetic organisms, or the nutritional value of microorganisms to higher orders of the food chain.[24]

21. Furthermore, as previously mentioned (see paras. 12 and 13 above), the uptake of carbon by the oceans is determined both by the solubility of $CO_2$ and transfer of carbon to the deeper layers of the oceans by the biological carbon pump. Under increased ocean acidification, the efficiency of the combined physical and biological uptake will change although the net direction of the change is also unpredictable.[25]

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[18] Interacademy Panel on International Issues, "IAP statement on ocean acidification", June 2009, available at www.interacademies.net.

[19] Ibid.

[20] See note 13 above. It should be noted, however, that changes in ocean chemistry owing to ocean acidification will be regionally variable with some regions affected more rapidly than others.

[21] See note 16 above.

[22] See note 1 above.

[23] For further details, also see the contributions of the Commission for the Conservation of Antarctic Marine Living Resources, the European Union, FAO, the General Fisheries Commission for the Mediterranean, ICRI, IUCN, OECD and UNDP.

[24] See note 1 above.

[25] See European Science Foundation, Science Policy Briefing No. 37: "Impacts of ocean acidification" available at www.ocean-acidification.net/OAdocs/ESF_SPB37_OceanAcidification.pdf.

22. Ocean acidification is likely to reduce the ability of oceans to absorb $CO_2$ thus leaving more $CO_2$ in the atmosphere and worsening its impact on the climate, making it more difficult to stabilize atmospheric $CO_2$ concentrations.[26] Predicted possible temperature rises could result in a decrease of 9-14 per cent of carbon dioxide uptake by the oceans by 2100.[27] In order to accurately predict the consequences of ocean acidification for marine biodiversity and ecosystems, these ecological effects may need to be considered in relation to other environmental changes associated with global climate change, and the interplay between the complex biological and chemical feedbacks. The severity of these impacts will also depend on the interaction of ocean acidification with other environmental stresses, such as rising ocean temperatures, overfishing and land-based sources of pollution.

23. These stressors operate in synergy with increasing acidification to compromise the health and continued function of many marine organisms. If pushed far enough, ecosystems may exceed a tipping point and change rapidly into an alternative state with reduced biodiversity, value and function.[28] In this regard, it is estimated that the cumulative impacts or interactive effects of multiple stressors will have more significant consequences for biota than any single stressor.[29]

### 1. Affected species and habitats

24. To date, little is known about biological responses in the marine environment. Since ocean acidification decreases the availability of carbonates in the ocean, it makes it more difficult for many marine organisms, such as corals, shellfish and marine plankton, to build their shells and skeletons. Many calcifiers provide habitat, shelter, and/or food for various plants and animals. The combination of increased acidity and decreased carbonate concentration also has implications for the physiological functions of numerous marine organisms, as well as broader marine ecosystems.[30] For example, as the ocean becomes more acidic, sound absorption at low frequencies decreases. This has generated concerns about possible impacts on background noise levels in the oceans. Ocean acidification could thus affect ocean noise and the ability of marine mammals to communicate.[31]

25. Calcification is the process that has been most thoroughly investigated. When seawater is supersaturated with carbonate minerals, the formation of shells and skeletons is favoured. The saturation horizon is the level in the oceans above which calcification can occur and below which carbonates readily dissolve. Shoaling or shallowing of the saturation horizon, which has already occurred in certain parts of the ocean, reduces the habitat available for calcifying organisms reliant on the carbonate minerals and has implications for ecosystem productivity, function and the provision of services, especially for cold and deep-water species such as cold-water corals.[32]

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[26] Fact sheet: "The ocean in a high $CO_2$ world", available at www.ocean-acidification.net.

[27] Ibid.

[28] See note 1 above.

[29] Ibid.

[30] There are three naturally occurring forms of calcium carbonate used by marine organisms to build shells, plates or skeletons: calcite, aragonite and high-magnesium calcite. See notes 1 and 15 above.

[31] See note 13 above.

[32] See note 1 above.

26. Marine organisms that use calcium carbonate to construct their shells or skeletons, including corals, coccolithophores, mussels, snails, and sea urchins, are the most vulnerable to ocean acidification. As carbonate becomes scarcer, these organisms will find it increasingly difficult to form their skeletal material.[33] Additionally, most multicellular marine organisms have evolved a regulatory system to maintain the hydrogen ion balance of their internal fluids. An increase in hydrogen ion concentration, known as acidosis, will lead to overall changes in the organism's morphology, metabolic state, physical activity and reproduction, as they divert energy away from these processes to compensate for the imbalance.[34]

27. Experimental evidence has demonstrated that increased carbon dioxide pressure (560 ppm) has a negative effect on calcification, causing a decrease in calcification rates of between 5 to 60 per cent in corals, coccolithophores, and foraminifera.[35] As the world's oceans become less saturated with carbonate minerals over time, marine organisms are expected to build weaker skeletons and shells, and experience slower growth rates which will make it increasingly difficult to retain a competitive advantage over other marine organisms.[36] Decreased calcification rates will slow the growth of coral reefs and make them more fragile and vulnerable to erosion.[37]

28. Some cold-water coral ecosystems could experience carbonate undersaturation as early as 2020.[38] By 2100, 70 per cent of cold-water corals, which provide habitat, feeding grounds, and nursery areas for many deep-water organisms, including commercial fish species, will be exposed to corrosive waters.[39] In the case of calcareous phytoplankton, some organisms likely to be affected by acidification are important prey for those higher up the food chain, including commercially fished species.[40] Fish larvae may be particularly sensitive to acidification.

29. In terms of ecosystem impacts, many calcifying species are located at the bottom or middle of global ocean food webs. Loss of calcifying organisms to ocean acidification will, therefore, alter predator-prey relationships, the effects of which will be transmitted throughout the ecosystem. For example, loss of calcified macroalgae would result in the subsequent loss of important habitat for adult fishes and invertebrates. The loss of key predators or grazing species from ecosystems could lead to environmental phase shifts (e.g. coral to algal dominated reefs), or favour the proliferation of non-food organisms, such as jellyfish. Non-calcifying species could also be affected by ocean acidification through food web control and pH-dependent metabolic processes.[41]

30. Given the complex and non-linear effects of ocean acidification, it is difficult to predict how ecosystem communities will respond to decreased calcification rates. In particular, it is not clear how impacts on individual organisms will propagate

[33] Fact sheet: "The ocean in a high $CO_2$ world", available at www.ocean-acidification.net.
[34] Ibid.
[35] See note 1 above.
[36] Ibid.
[37] Ibid.
[38] Ibid.
[39] See note 16 above.
[40] Ibid.
[41] See note 1 above.

through marine ecosystems, or if marine food webs can reorganize themselves to make up for the loss of some key elements.[42]

31. The reduction and possibly regional cessation of calcification by organisms in the oceans would strongly affect ecosystem regulation and the flow of organic material to the sea floor, through the removal of calcium carbonate density and the reduced efficiency of the biological pump to transfer carbon into the ocean. Any reduction in total biomass production, either through reduced photosynthesis or from greater energy demand to obtain critical nutrients, would also have significant implications for global marine food webs.

32. The impacts of ocean acidification will also depend on the specific physiological adaptation mechanisms of species, and the energetic costs of maintaining these over the long term. The capacity of marine species to adapt to increased levels of carbon dioxide concentration may be a function of species generation time, with long-lived species, such as corals, being less able to respond.[43] The adaptability of most organisms to increasing acidity is currently unknown. Although some marine organisms may also benefit from ocean acidification, even positive effects on one species can have a disruptive impact on food chains, community dynamics, biodiversity and ecosystem structure and function.[44] Evidence from naturally acidified locations confirms that, although some species may benefit, biological communities under acidified seawater conditions are less diverse and calcifying species absent.[45]

### 2. Related socioeconomic impacts

33. The oceans provide numerous ecosystem services that benefit humankind. These services, for example in fisheries, coastal protection, tourism, carbon sequestration and climate regulation contribute significantly to global employment and economic activity. They could be strongly affected by ocean acidification.[46] Many of the species most sensitive to ocean acidification are directly or indirectly of great cultural, economic or ecological importance, such as warm-water corals that reduce coastal erosion and provide habitat for many other species.[47] Attempts to quantify some of these services have produced estimates of many billions of dollars.[48]

34. Although the impacts of ocean acidification on marine species and ecosystem processes are still poorly understood, the predicted socioeconomic consequences are profound.[49] In particular, ocean acidification could alter species composition,

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[42] Ibid.

[43] Ibid.

[44] D. d'A Laffoley and J. M. Baxter (editors), "Ocean Acidification: The knowledge base 2012: updating what we know about ocean acidification and key global challenges", paper of the European Project on Ocean Acidification, 2012.

[45] See note 1 above.

[46] Ibid.

[47] See note 20 above.

[48] See note 1 above.

[49] Ibid. See also EUR-OCEANS, Fact Sheet 7: "Ocean acidification — the other half of the $CO_2$ problem" (2007), available at www.eur-oceans.eu.http://www.eur-oceans.eu/?q=node/18117.

disrupt marine food webs and ecosystems and potentially damage fishing, tourism and other human activities connected to the seas.[50]

35. Ocean acidification could also affect the carbon cycle and the stabilization of atmospheric carbon dioxide (see paras. 9-13 above). Thus, ocean acidification could exacerbate anthropogenic climate change and its effects. According to one estimate, ocean uptake of carbon dioxide represents an annual subsidy to the global economy of US$ 40 to 400 billion, or 0.1 to 1 per cent of the gross world product. The projected decrease in efficiency of the ocean carbon pump could thus represent an annual loss of billions of dollars.[51]

*Tropical coral reefs*

36. Ocean acidification will make large areas of the oceans inhospitable to coral reefs, and impact the continued provision of the goods and services that these reefs provide to the world's poorest people.[52] Tropical coral reefs are estimated to provide in excess of US$ 30 billion annually in global goods and services, such as coastline protection, tourism, and food security, which are vital to human societies and industries.[53] Under the rapid economic growth global emissions scenario, the annual economic damage of ocean acidification-induced coral reef loss could reach $870 billion by 2100.[54]

*Fisheries and aquaculture*

37. The impacts of ocean acidification could also affect commercial fish stocks, threatening food security, as well as fishing and shellfish industries.[55] In particular, ocean acidification could slow or reverse marine plant and animal carbonate shell and skeleton growth, with a corresponding decrease in fishing revenues with significant impacts for communities that depend on the resources for income and livelihoods.[56]

38. While hard to predict, early estimates of the direct impacts of ocean acidification on marine fishery production are in the order of US$ 10 billion per year.[57] A study estimated that the global and regional economic costs of production loss of molluscs due to ocean acidification would be over US$ 100 billion by the year 2100.[58]

39. In the long term, economic changes resulting from fishery losses on a local scale could alter the dominant economic activities and demographics, and accelerate the proportion of the population living below the poverty line in dependent communities that have little economic resilience or few alternatives.[59]

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[50] Ibid.

[51] See note 16 above.

[52] See note 1 above.

[53] In the tropics, coral reefs produce 10-12 per cent of the fish caught and 20-25 per cent of the fish caught by developing nations. See note 1 above.

[54] See note 1 above.

[55] See note 16 above.

[56] See note 1 above.

[57] Ibid.

[58] Daiju Narita and others, "Economic costs of ocean acidification: a look into the impacts on global shellfish production", *Climatic Change*, vol. 113, Issue 3-4, pp. 1049-1063.

[59] See note 1 above.

# III. Ocean acidification and the international legal and policy framework

40. Although the upcoming meeting of the Informal Consultative Process is expected to focus on the scientific and technical aspects of ocean acidification, some elements of the existing legal and policy framework for the oceans and seas may be usefully highlighted as potentially relevant for addressing ocean acidification.

41. There is currently no global international instrument specifically dedicated to addressing ocean acidification or its impacts on the marine environment. Nevertheless, a number of existing international instruments, at the global and regional levels, may contain relevant provisions. In addition, there are a number of important non-binding instruments in which States have committed to meeting objectives relevant to addressing the impacts of ocean acidification.

## A. Binding instruments

42. The United Nations Convention on the Law of the Sea of 10 December 1982 sets out the legal framework within which all activities in the oceans and seas must be carried out.[60] In this regard, it provides the overarching legal framework for the protection and preservation of the marine environment. The substantive obligations to protect and preserve the marine environment and to take all measures necessary to prevent, reduce and control pollution of the marine environment from any source (arts. 192 and 194),[61] as well as the related procedural obligations contained in Part XII would thus seem particularly relevant in the context of ocean acidification. The regime for marine scientific research and for the transfer of marine technology set out, respectively, in Parts XIII and XIV of the Convention may also be of relevance.

43. The 1994 United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks sets out principles for the conservation and management of those fish stocks and establishes that such management must be based on the precautionary approach and the best available scientific information. It requires States parties to, inter alia, minimize pollution and protect biodiversity in the marine environment.[62]

44. The Convention on Biological Diversity establishes a regime for the conservation and sustainable use of biological diversity and the equitable sharing of the benefits arising out of its utilization, which complements the United Nations

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[60] See General Assembly resolution 67/78, preamble.

[61] Art. 1 (4) of the Convention defines pollution of the marine environment as "the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the seas, impairment of quality for use of sea water and reduction of amenities". There has been some discussion on whether the absorption of $CO_2$ into the marine environment can be considered pollution under the Convention. See, e.g., the contribution of the European Union.

[62] United Nations, *Treaty Series*, vol. 2167, No. 37924, art. 5.

Convention on the Law of the Sea in relation to marine biodiversity.[63] Although the Convention on Biological Diversity does not specifically address ocean acidification, its Conference of the Parties has recognized the potential impacts of ocean acidification on biodiversity and noted that it meets the requirements of a new and emerging issue. In this regard, it has taken a number of decisions (see sect. IV below), pursuant to the Jakarta Mandate.[64] In particular, the Conference of the Parties agreed to the Aichi Biodiversity Target 10, which provides that "[b]y 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning".[65] The Conference of the Parties has also taken a number of decisions with regard to ocean fertilization as a method to sequester $CO_2$.

45. The United Nations Framework Convention on Climate Change and the Kyoto Protocol establish a global regime for addressing anthropogenic climate change due to the release into the environment of certain greenhouse gases, but do not deal specifically with the phenomenon of ocean acidification. However, to the extent that it regulates emissions of $CO_2$ as a greenhouse gas, the legal framework established by these instruments may also be relevant to addressing ocean acidification.

46. In 2011, parties to annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL) agreed to adopt amendments to establish the first-ever mandatory global greenhouse gas reduction regime for an international industry sector (see para. 76 below). These amendments entered into force on 1 January 2013. IMO continues its discussions on market-based measures to address greenhouse gas emissions from ships and on the assessment of the impacts of such measures on developing countries. While this framework does not specifically address ocean acidification, it may contribute to a reduction of $CO_2$ emissions.

47. The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention, 1972) and the 1996 Protocol to the Convention (London Protocol) set up a legal regime to regulate the dumping of wastes and other matter into the oceans. In this context, the Contracting Parties have regulated the capture and sequestration of $CO_2$ waste streams in sub-seabed geological formations, for permanent isolation of $CO_2$. The Contracting Parties have also been considering marine geoengineering activities such as ocean fertilization, with the aim of providing a global, transparent and effective control and regulatory mechanism for ocean fertilization activities and other activities that fall within the scope of the London Convention and the London Protocol and have the potential to cause harm to the marine environment. Ocean fertilization potentially involves the increased absorption of $CO_2$ by the oceans (see para. 77 below).

48. A number of regional instruments, including regional seas conventions, may also contain general provisions relevant to addressing ocean acidification.

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[63] United Nations, *Treaty Series*, vol. 1760, No. 30619, art. 1.

[64] See the contribution of the Convention on Biological Diversity.

[65] See www.cbd.int/sp/targets/.

## B. Non-binding instruments

49. Member States have also expressed their commitments to addressing ocean acidification and its impacts in a number of important non-binding instruments. These instruments, in some cases, also set out principles applicable to the protection of the marine environment, such as the precautionary and ecosystems approaches and the polluter-pays principle. These include Agenda 21 and the Johannesburg Plan of Implementation, as well as the outcome document of the United Nations Conference on Sustainable Development, held in Rio de Janeiro, Brazil, in 2012. Therein, States called for support to initiatives that address ocean acidification on marine and coastal ecosystems and resources and reiterated the need to work collectively to prevent further ocean acidification, as well as enhance the resilience of marine ecosystems and of the communities whose livelihoods depend on them, and to support marine scientific research, monitoring and observation of ocean acidification and particularly vulnerable ecosystems, including through enhanced international cooperation in this regard. They also stressed their concern about the potential environmental impacts of ocean fertilization.[66]

50. The Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, which provides guidance to national and/or regional authorities in devising and implementing sustained action to prevent, reduce, control and/or eliminate marine degradation from land-based activities, is also of relevance.

# IV. Initiatives and activities related to the impacts of ocean acidification on the marine environment

## A. Research and monitoring

51. The importance of research into ocean acidification and its monitoring have long been highlighted, including by the General Assembly, with the view to finding ways to prevent or slow down the rising acidity of the oceans.

### 1. At the global level

52. Ocean acidification research and monitoring activities have been growing rapidly to address the consequences of ocean acidification and associated impacts on marine living resources, ecosystems and ecosystem services. Research is also focusing on socioeconomic impacts. Some of these initiatives are described below.

*Impacts on marine biodiversity and ecosystems*

53. In 2007, the Intergovernmental Panel on Climate Change included a variety of references to ocean acidification in its Fourth Assessment Report.[67] Subsequently, in 2011, the Panel held a workshop on the theme "Impacts of ocean acidification on

[66] Outcome of the United Nations Conference on Sustainable Development, entitled "The future we want" (General Assembly resolution 66/288), annex, paras. 166 and 167.

[67] See www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm.

marine biology and ecosystems".[68] The workshop summarized the body of science on ocean acidification and contributed to the Fifth Assessment Report, which will include comprehensive coverage of ocean acidification and its impacts, including potential feedbacks to the climate system.[69]

54. In 2010, the Conference of the Parties to the Convention on Biological Diversity identified ocean acidification as a serious concern. In this regard, it welcomed the study entitled *Scientific Synthesis of the Impacts of Ocean Acidification on Marine Biodiversity*, which provided a synthesis of scientific information on the impacts of ocean acidification and described possible ecological scenarios and adverse impacts of ocean acidification on marine biodiversity.[70] Currently, the Convention secretariat is collaborating with relevant organizations to prepare a systematic review document on the impact of ocean acidification on biodiversity and ecosystem function.[71]

55. In accordance with a request from the tenth meeting of the Conference of the Parties, an expert meeting to develop a series of joint expert review processes to monitor and assess the impacts of ocean acidification on marine and coastal biodiversity was convened in 2011, in collaboration with IOC-UNESCO, FAO, the Framework Convention, the UNEP World Conservation Monitoring Centre, ICRI, the Ramsar Convention, the Antarctic Treaty and the Arctic Council. Its report focused on the theme "Implications for Arctic and polar regions of the Convention of Biological Diversity report on ocean acidification".[72] The eleventh meeting of the Conference of the Parties, held in 2012, took note of the elements suggested by the Expert Meeting as guidance to support the parties in the realization of practical responses to ocean acidification impacts on marine and coastal biodiversity.[73]

*Impacts on fisheries*

56. IAEA has been developing activities with focus on the impact on fisheries and fishery communities. In 2012, IAEA began a four-year coordinated research project focused on key ocean ecosystems south of 30°N latitude. The overall objective of the project is to evaluate potential biological and socioeconomic impacts of ocean acidification, and the implications for sustainable food security for coastal society. Currently six IAEA member States[74] are participating in regional case studies of potential ocean acidification impacts on fisheries and fisher communities. Furthermore, at IAEA Marine Environment Laboratories, experiments are carried out to assess direct and indirect impacts of ocean acidification on the marine environment and its resources including impact on key species for fisheries and aquaculture using radiological technologies.[75]

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[68] See http://ipcc-wg2.gov/meetings/workshops/OceanAcidification_WorkshopReport.pdf.

[69] The Fifth Assessment Report is expected to be finalized in 2014.

[70] Reproduced in UNEP/CBD/SBSTTA/14/INF/8, available at www.cbd.int/doc/meetings/sbstta/sbstta-14/information/sbstta-14-inf-08-en.pdf.

[71] Contribution of the Convention on Biological Diversity.

[72] See http://arctic.ucalgary.ca/files/arctic/June2012-OceanAcidificationSummary.pdf.

[73] See UNEP/CBD/SBSTTA/16/6, paras. 13-15.

[74] Chile, Brazil, Ghana, Kenya, Kuwait and the Philippines.

[75] Contribution of IAEA.

*Impacts on coral reefs*

57. As a result of a recommendation adopted by ICRI on acidification and coral reefs,[76] a briefing paper on acidification and coral reefs by the International Society of Reef Studies was published for the Eleventh International Coral Reef Symposium, held in 2008.[77] Additionally, in 2010, the Global Coral Reef Monitoring Network, an operational network of ICRI, published a document entitled "Climate change and coral reefs: consequences of inaction", which introduced available knowledge on the effects of acidification on reef systems.[78] In 2012, the Alliance of Small Island States Leaders issued a declaration reiterating alarm and concern about, among others, ocean acidification's impacts and coral bleaching. The Leaders underscored their commitments to the establishment of an international mechanism that would include a "solidarity fund" to provide compensation for permanent loss and damage caused by slow onset impacts such as ocean acidification.[79]

*Research into socioeconomic impacts*

58. In 2010, the IAEA Marine Environment Laboratories organized the first International Workshop on the theme "Bridging the gap between ocean acidification impacts and economic valuation".[80] The output of the meeting included a baseline of scientific and economic information and recommendations concerning the anticipated impacts to ecosystems from ocean acidification. Subsequently, in 2012, the Second International Workshop, jointly hosted by IAEA and IOC-UNESCO, focused on the impacts of ocean acidification on fisheries and aquaculture and the resulting economic consequences.[81]

59. In addition, the Ocean Acidification International Coordination Centre was established at the IAEA Environment Laboratories in Monaco in 2012.[82] The goal of the Centre is to facilitate and promote global activities on ocean acidification including international observation, joint platforms and facilities, definition of best practices, data management and capacity-building.

*Inter-agency initiatives for ocean acidification research and monitoring*

60. The report "Summary for decision makers: a blueprint for ocean and coastal sustainability",[83] prepared as input into the 2012 United Nations Conference on Sustainable Development, contained a number of proposals such as the launch of a global interdisciplinary programme on ocean acidification risk assessment, the integration of the ocean acidification dimension within the negotiation processes of the United Nations Framework Convention on Climate Change, and the

[76] See http://02cbb49.netsolhost.com/library/Reco_acidification_2007.pdf.

[77] See www.icriforum.org/sites/default/files/ISRS_BP_ocean_acid_final28jan2008.pdf.

[78] See www.icriforum.org/sites/default/files/GCRMN_Climate_Change.pdf.

[79] See http://aosis.org/wp-content/uploads/2012/10/2012-AOSIS-Leaders-Declaration.pdf.

[80] See www.centrescientifique.mc/csmuk/informations/2011_12_recommendations.php.

[81] See www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/pdf_Acidification_Monaco_Workshop_2012_Objectives.pdf.

[82] See www.iaea.org/newscenter/pressreleases/2012/prn201218.html; http://oa-coordination.org/ (centre website, forthcoming).

[83] See www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/summary_interagency_blue_paper_ocean_rioPlus20.pdf.

coordination of international research to better understand the impacts of ocean acidification on marine ecosystems.[84]

61. The International Ocean Carbon Coordination Project promotes a global network of ocean carbon observation research and sharing of data on ocean acidification. It is co-sponsored by IOC-UNESCO and the Scientific Committee on Oceanic Research, and has links to the global ocean observing systems. The Project convenes workshops and develops manuals on ocean carbon measurement methods and systems which serve to improve ocean acidification investigations and the intercomparability of ongoing experiments and studies worldwide. It has published the "Guide to Best Practices for Oceanic $CO_2$ Measurements" and organized the International Workshop to Develop an Ocean Acidification Observing Network of Ship Surveys, Moorings, Floats and Gliders in 2012.[85] A joint Integrated Marine Biogeochemistry and Ecosystem Research and Surface Ocean-Lower Atmosphere Study Carbon Implementation Group was established, which focuses on carbon inventories, fluxes and transports and sensitivities of carbon-relevant processes to changes occurring in the ocean.[86]

62. The International Ocean Carbon Coordination Project held an international time-series method workshop in 2012 which offered a platform to focus on time-series methods and data intercomparison.[87] Time series are valuable tools for oceanographers to observe trends, understand carbon fluxes and processes, and to demonstrate the crucial role that the carbon cycle plays in climate regulation and feedback. IOC-UNESCO is working on a new compilation of existing biogeochemical time series. In total, 125 biogeochemical time series have been compiled from around the world.[88]

### 2. At the regional level

63. Although ocean acidification is a global environmental problem that requires concerted global action, some measures have also been taken at the regional level.

64. The Marine Strategy Framework Directive of the European Union came into force on 15 June 2008. The Framework Directive allows the European Union to tackle, through various management measures, a whole range of pressures and impacts on marine ecosystems.[89]

65. In 2008, the European Project on Ocean Acidification was launched to investigate ocean acidification and its consequences as a multinational effort that included 32 laboratories located in 10 European States.[90] The four-year research project aimed to monitor ocean acidification and its effects on marine organisms and ecosystems, to identify the risks of continued acidification and to understand how these changes will affect the Earth system as a whole. The Mediterranean Sea Acidification in a Changing Climate is assessing the chemical, climatic, ecological, biological, and economical changes of the Mediterranean Sea driven by increases in

[84] The Blueprint report is a collaboration between IOC-UNESCO, FAO, IMO and United Nations Development Programme (UNDP).

[85] See http://pmel.noaa.gov/co2/OA2012Workshop/WorkshopGoals.html.

[86] See http://solas-int.org/solasimber-carbon-group.html.

[87] See www.whoi.edu/website/TS-workshop/home.

[88] Contribution of IOC-UNESCO.

[89] Contribution of the European Union.

[90] See www. epoca-project.eu/.

$CO_2$ and other greenhouse gases. In particular, it aims to identify where the impacts of acidification in Mediterranean waters will be more significant.[91]

66. In the Bergen Statement of the Ministerial Meeting of the OSPAR Commission held in 2010, States parties to the OSPAR Convention noted, in particular, that the impacts of climate change and ocean acidification were predicted to profoundly affect the productivity, biodiversity and socioeconomic value of marine ecosystems. They emphasized that research into and considerations of these effects, as well as the need for adaptation and mitigation, would have to be integrated in all aspects of the Commission's work, including through collaboration with international organizations on investigating, monitoring and assessing the rate and extent of these effects and considering appropriate responses. The Commission has taken steps towards the inclusion of chemical ocean acidification in its Common Environmental Monitoring Programme. In 2012, it decided to include in its work programme for 2013 the establishment of a joint study group on ocean acidification with the International Council for the Exploration of the Sea.[92]

67. The Arctic Ocean Acidification Expert Group has begun work on an assessment report of Arctic Ocean acidification covering the carbon dioxide system in the ocean, biogeochemical processes, responses of organisms and ecosystems and the economic costs of acidification in the Arctic Ocean. The Arctic Monitoring and Assessment Programme, an international organization established in 1991 to implement components of the Arctic Environmental Protection Strategy of the Arctic Council, will conduct a full scientific assessment of Arctic Ocean acidification for delivery in 2013.

68. The Scientific Committee on Antarctic Research was requested by the Antarctic Treaty Consultative Meeting to produce a comprehensive report focusing on both ecosystems and species responses to ocean acidification.[93]

69. The members of the Commission for the Conservation of Antarctic Marine Living Resources place a high level of importance on monitoring ecosystem health in the Southern Ocean. Since the early 1980s Commission members have supported a programme to monitor key components of the Antarctic marine ecosystem to understand and distinguish between change arising from activities such as fishing and change occurring as a result of environmental variability. Krill, which is the critical component of the Antarctic ecosystem, has been the focus of this work, which started in 1984 under the auspices of the Commission's Environmental Monitoring Programme. Commission scientists have recognized the potential effects of a lowering of pH on crustacean exoskeleton calcification, which means that krill embryonic development may be affected by ocean acidification while acid-base regulation, in larvae and post-larvae, may compromise the somatic growth, reproduction, fitness, and behaviour. Commission members are engaged in research programmes to provide sustained observations of population and condition parameters of krill in order to detect potential effects of ocean acidification as well as to fill knowledge gaps in the biology and ecology of the Antarctic krill.[94]

[91] Ibid.

[92] Contribution of OSPAR.

[93] Contribution of the secretariat of the Antarctic Treaty.

[94] Contribution of the Commission.

70. The Initiative for the Protection and Management of Coral Reefs in the Pacific aims to develop a vision for the future of the unique ecosystems and the communities that depend on them. In October 2009, the Initiative released a scientific review on acidification and coral reefs to raise awareness among decision makers. The conference report focuses on the consequences of ocean acidification for the sustainability of coral structures.[95]

71. Through the secretariats and regional coordinating units of the Nairobi and Abidjan conventions, signatories to the two conventions have, from 2008 to 2010, accelerated efforts towards development and adoption of new protocols for preventing, reducing, mitigating and controlling pollution emanating from land-based sources and activities. It is expected that the enforcement of these protocols will contribute towards restoring ecosystem resilience through activities that address, for example, ocean acidification.[96]

## B. Mitigation initiatives and activities

### 1. At the global level

72. In addition to research, immediate and coordinated action is required to reduce and adapt to the impacts of ocean acidification.[97]

73. Stabilizing and reducing $CO_2$ emissions in the atmosphere is considered as an effective mitigation strategy for ocean acidification. IOC-UNESCO, IAEA, the Scientific Committee on Oceanic Research and the International Geosphere-Biosphere Programme organized a series of international symposiums on the theme "The ocean in a high $CO_2$ world". The first two symposiums, in 2004 and 2008, resulted, respectively, in the creation of an Ocean Acidification Network[98] and in the adoption in 2008 of the Monaco Declaration, which called for substantial reductions in $CO_2$ emissions to avoid widespread damage to marine ecosystems caused by ocean acidification.[99]

74. The 2010 report, entitled "UNEP emerging issues: environmental consequences of ocean acidification: a threat to food security", suggested actions that are necessary to mitigate the risk of effects of ocean acidification in view of its potential future impacts on organisms, ecosystems and food providing products.[100]

75. The Aichi Biodiversity Target 10 of the Strategic Plan for Biodiversity 2011-2020, adopted by the Conference of the Parties to the Convention on Biological Diversity, calls for minimizing the multiple anthropogenic pressures on coral reefs and other vulnerable ecosystems impacted by climate change or ocean acidification by 2015.[101] In a resolution to implement Aichi Target 12, IUCN called

[95] See www.icriforum.org/sites/default/files/C3B_Acidification.pdf.

[96] Report of the Africa Regional Seas Programme, 2008-2010, available at www.unep.org/roa/amcen/Amcen_Events/13th_Session/Docs/Report_RegionalSeas2008_2010.pdf.

[97] www.unesco.org/new/en/natural-sciences/ioc-oceans/priority-areas/rio-20-ocean/10-proposals-for-the-ocean/1a-ocean-acidification/.

[98] www.ocean-acidification.net/.

[99] www.iaea.org/newscenter/news/pdf/monacodecl061008.pdf.

[100] www.unep.org/dewa/Portals/67/pdf/Ocean_Acidification.pdf.

[101] www.cbd.int/sp/targets/.

on the scientific community to conduct research on ocean acidification and to develop practical management options to mitigate their impact on threatened species.[102]

76. Under MARPOL and its modified Protocol, IMO has adopted a comprehensive mandatory regime aimed at limiting or reducing greenhouse gas emissions from ships which includes the adoption of both technical and operational measures. These are designed to put in place best practices for fuel efficiency, in particular, an energy efficiency design index for new vessels and an energy management plan for both new and existing ships.

77. Since 2005, under the London Convention and London Protocol, progress was achieved towards regulating $CO_2$ sequestration in sub-seabed geological formations. In 2012, the Meeting of Contracting Parties adopted a revised version of the Specific Guidelines for Assessment of Carbon Dioxide Streams for Disposal into Sub-seabed Geological Formations to take into account the transboundary migration of carbon dioxide waste streams within sub-seabed geological formations. The meeting further considered a draft text for the "Development and implementation of arrangements or agreements for the export of $CO_2$ streams for storage in sub-seabed geological formation". Discussions have also taken place regarding large-scale iron fertilization of the oceans to sequester $CO_2$ with the aim of drawing down an additional amount of surplus $CO_2$ from the atmosphere into the oceans. Currently, the main focus is to amend the London Protocol with a view to regulating marine geoengineering activities such as ocean fertilization activities, including a mechanism for the future listing of other marine geoengineering activities.[103]

### 2. At the regional level

78. Under the OSPAR Convention, ocean acidification, as a process caused by the indirect introduction of $CO_2$ into the ocean, is likely to result in harm to maritime ecosystems. Under article 2 of the OSPAR Convention, a wide-ranging obligation engages States parties to take all possible steps to prevent and eliminate pollution and to take the measures necessary to protect the maritime area against the adverse effects of human activities. In 2007, amendments to annexes II and III to the OSPAR Convention were adopted to allow carbon capture and sequestration in geological formations under the seabed as a mitigation strategy. Additionally, OSPAR Decision 2007/2 on the storage of carbon dioxide streams in geological formations was adopted to ensure the environmentally safe storage of liquefied $CO_2$ in geological formations pursuant to the OSPAR Guidelines for Risk Assessment and Management. Mindful of the acidification impacts of $CO_2$, OSPAR parties also adopted decision 2007/1 to prohibit the placement of $CO_2$ in the water column or on the seabed.[104]

79. The Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security is a multilateral partnership of six countries working together to sustain their marine and coastal resources by addressing crucial issues such as food security, climate change and marine biodiversity. Within the context of regional exchanges on the

[102] http://portals.iucn.org/docs/iucnpolicy/2012-resolutions%5Cen/WCC-2012-Res-014-EN%20Implementing%20Aichi%20Target%2012%20of%20the%20Strategic%20Plan%20for%20Biodiversity%202011-2020.pdf.

[103] Contribution of IMO.

[104] Contribution of OSPAR.

implementation of an ecosystem approach to fisheries management, in 2012, the Initiative held its third workshop, which identified as a target the need to improve understanding of the impacts of climate change and ocean acidification on nearshore fisheries. The workshop developed the draft Coral Triangle Ecosystem Approach to Fisheries Management Regional Guidelines. The countries agreed that the ecosystem approach framework addresses in broad terms everything that concerns fisheries management and therefore all the priority themes of the Initiative, including climate change, ocean acidification, habitat protection through marine protected areas, illegal, unreported and unregulated fishing and live reef fish trade, even if these are not specifically referred to.[105]

80. The European Commission, in March 2011, issued four guidance documents to support coherent implementation of the European Union Directive on the geological storage of carbon dioxide. Additionally, the European Union Member States submitted project proposals for renewable energy and clean technologies involving innovative renewable energy and carbon capture and sequestration technologies.[106]

81. At the first regional conference on the theme "Climate change impacts, adaptation and mitigation in the Western Indian Ocean region: solutions to the crisis" (Mauritius), West Indian Ocean countries were encouraged to initiate mitigation policies, including the development of ocean-based renewable energy; the rehabilitation of critical coastal habitats and their components, including coastal forest and seagrass habitats and enhancement of the reduction of greenhouse gas emissions through forests by developing and implementing national and regional blue carbon and reducing emissions from deforestation and forest degradation (REDD)-plus programmes and strategies with a transboundary focus, as appropriate.[107]

## C. Adaptation initiatives and activities

82. Policies to limit marine pollution and curtail overfishing may have a positive effect on the ability of marine ecosystems to adapt to acidifying conditions. They may include limiting the vulnerability of marine ecosystems, expanding freshwater aquaculture operations and supporting communities and countries facing economic disruptions.[108]

83. In November 2012, IAEA and the Monaco Scientific Centre jointly hosted the Second International Workshop on the theme "Bridging the gap between ocean acidification impacts and economic valuation".[109] The Workshop focused on fisheries and aquaculture, and regional aspects of species vulnerability and socioeconomic adaptation. Its recommendations included the following: to implement best practices and adaptive management of fisheries resources and aquaculture operations by addressing overfishing, discouraging illegal, unregulated,

[105] See www.coraltriangleinitiative.org/sites/default/files/resources/Third%20CTI%20Regional%20Exchange%20on%20the%20Implementation%20of%20EAFM%20in%20CT%20Countries%20May%202012.pdf.

[106] Contribution of the European Union.

[107] See www.wiomsa.net/images/stories/Climate%20Change%20Conference_Final%20Statement.pdf.

[108] See www.sciencepolicyjournal.org/uploads/5/4/3/4/5434385/_ocean_acidification.pdf.

[109] See www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/pdf_Acidification_Monaco_Workshop_2012_Objectives.pdf.

unreported fishing, and encouraging polyculture and selective breeding; and to increase the adaptive capacity of fishing communities through education concerning ocean acidification impacts on marine resources and training to diversify livelihoods.[110]

84. In 2010, the OECD Fisheries Committee and the Government of the Republic of Korea hosted a workshop on the economics of adapting fisheries to climate change. The objective was to provide a forum for policymakers, economists, biologists, international organizations, the private sector and non-governmental organizations to examine the economic issues, policy challenges and institutional frameworks and responses to adapting to climate change.[111] The workshop discussed acidification by providing an overview of the key challenges facing the management of fisheries and aquaculture in a world increasingly characterized by a changing climate induced primarily by the anthropogenic emissions of $CO_2$.

85. Other initiatives focused on enhancing coral reef resilience to ocean acidification. The World Meteorological Organization produced the report *Climate, Carbon and Coral Reefs*, which summarized the $CO_2$ threat to coral reefs, the science supporting projections and the solutions that are needed to prevent the loss of coral reefs.[112]

86. In addition, the Honolulu Declaration on Ocean Acidification and Reef Management was produced as a result of a meeting on ocean acidification held in 2008 by the Nature Conservancy and IUCN.[113] The Declaration introduced several policy recommendations to enhance coral reef resilience to ocean acidification. The IUCN Climate Change and Coral Reefs Marine Working Group works towards limiting fossil fuel emissions and building the resilience of tropical marine ecosystems and communities.

# V. Challenges and opportunities in addressing the impacts of ocean acidification

## A. Addressing knowledge gaps

87. Although ocean acidification appears to be an observable and predictable consequence of increasing atmospheric $CO_2$, the precise scope of its impact on the marine environment remains unclear. Over the past five years, there has been a considerable increase in scientific resources dedicated to the study of this phenomenon. However, the United Nations Conference on Sustainable Development reiterated the need to support marine scientific research, monitoring and observation of ocean acidification and particularly vulnerable ecosystems, including through enhanced international cooperation. The General Assembly has encouraged States and competent international organizations and other relevant institutions,

[110] Contribution of FAO.

[111] See OECD, *The Economics of Adapting Fisheries to Climate Change* (OECD Publishing, 2011), available at www.oecd-ilibrary.org/agriculture-and-food/the-economics-of-adapting-fisheries-to-climate-change_9789264090415-en.

[112] See http://coralreef.noaa.gov/education/oa/resources/climate_carbon_coralreefs_un_report.pdf.

[113] See http://coralreef.noaa.gov/aboutcrcp/strategy/reprioritization/wgroups/resources/climate/resources/oa_honolulu.pdf.

individually and in cooperation, to urgently pursue further research on ocean acidification, especially programmes of observation and measurement.[114]

88. The resulting impacts of ocean acidification on marine species and ecosystem processes are still poorly understood. In this regard, a number of specific knowledge gaps have been identified,[115] including at intergovernmental and expert meetings.[116] For example, many questions remain about the biological and biogeochemical consequences of acidification, and the accurate determination of subcritical levels, or "tipping points", for global marine species, ecosystems and services. Most understanding of biological impacts due to ocean acidification is derived from studies of individual organism responses. There is therefore a critical need for information on impacts at the ecosystem level, which would include the interaction of multiple stressors, such as those related to climate change.[117] Moreover, limited study has been conducted regarding how a number of other variables, including carbonate concentration, light levels, temperature and nutrients, would affect calcification processes.

89. There is also a need for more spatially distributed and temporally intensive studies of ocean pH dynamics and their underlying causal mechanisms and consequences, along with a focus on the adaptive capacities of marine organisms, which will be crucial to forecasting how organisms and ecosystems will respond as the world's oceans warm and acidify.[118] Experts have pointed to future priorities for ocean acidification research, such as the need for long-term experiments, meta-analysis of data, the use of advanced modelling, the development of global and regional networks for ocean acidification observations and making a link to social sciences and socioeconomic impacts.[119] Additional research is also needed with regard to the effectiveness and the overall impact of various possible adaptation measures.

90. Understanding of the short-term impacts of ocean acidification on different species of marine biota is building, and continuing scientific experimentation is facilitating a growing understanding of its wider ecosystem and long-term implications. In this regard, over the past few years there have been numerous initiatives at all levels to increase and improve scientific research, with a view to addressing knowledge gaps.[120] Increased cooperation and coordination of scientists through expert meetings, joint projects and information exchange mechanisms is also expected to contribute to improving scientific understanding of the effects of ocean acidification on the marine environment.[121] The establishment of the International Coordination Centre for Ocean Acidification, in Monaco, may be instrumental in this regard (see para. 59 above).

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[114] Resolution 67/78, para. 143.

[115] Contribution of the European Union.

[116] See, e.g., report of the Expert Meeting to develop a series of joint expert review processes to monitor and assess the impacts of ocean acidification on marine and coastal biodiversity (UNEP/CBD/SBSTTA/16/INF/14), annex III.

[117] See Convention on Biological Diversity Study, p. 10.

[118] UNEP Convention on Biological Diversity issue paper No. 7, p. 3.

[119] See UNEP/CBD/SBSTTA/16/INF/14, annex II.

[120] See sect. III above.

[121] Contributions of the Antarctic Treaty secretariat, the European Union, FAO, IAEA and IOC-UNESCO.

91. IUCN pointed out that the first global integrated assessment of the state of the marine environment, including socioeconomic aspects could also provide information on ocean acidification and its effects on the marine environment.[122] Another important element of addressing knowledge gaps is improving the science-policy interface with regard to ocean acidification, by enhancing communication between scientists and policymakers, as well as outreach efforts towards the media and the public. It should be noted that the gaps in the current scientific knowledge regarding the impacts of ocean acidification on the marine environment, particularly at the ecosystem level, may hamper the implementation of the existing legal and policy framework for oceans and seas. The inclusion of key stakeholders, including fishers, in discussions relating to ocean acidification was also highlighted as an important goal. Capacity-building measures designed to increase participation of scientists from developing countries in ocean acidification research are also key to addressing knowledge gaps.[123]

## B. Mitigation and adaptation

*Mitigation*

92. As also noted in section II above, ocean uptake of $CO_2$ will continue in response to anthropogenic emissions. According to current scientific understanding, ocean acidification may be irreversible on very long time frames, and is determined, in the longer term, by physical mixing processes within the oceans that allow ocean sediments to buffer the changes in ocean chemistry. Warming of the oceans as a result of global climate change may reduce the rate of mixing with deeper waters, and it is likely that the rapid increases in atmospheric $CO_2$ concentrations could eventually overwhelm the natural buffering mechanisms of the ocean, leading to a reduced efficiency for carbon uptake by the oceans over the next two centuries. Reduced buffering capacity of the oceans to take up $CO_2$ will increase the fraction of $CO_2$ retained in the atmosphere, a negative feedback loop leading to further ocean acidification.[124]

93. The primary means of avoiding the impacts of ocean acidification is to reduce $CO_2$ emissions through a transition to a low-carbon energy economy.[125] Global-scale reductions in $CO_2$ emissions, along with local reductions in anthropogenic sources of acidification,[126] are also urgently needed. Atmospheric $CO_2$ is already at 390 ppm and is increasing at about 2 ppm per year, and might peak well above 400 ppm in a scenario of continuing emissions in the next five years. The chemistry of seawater is reversible, and it is believed that returning to 350-400 ppm would return pH and carbonate saturation levels to approximately their current conditions. However, some research has suggested that even current day conditions may be deleterious for some organisms, and it is even less clear if future biological impacts due to peak $CO_2$ will be reversible. Even if $CO_2$ emissions are stabilized, atmospheric fossil fuel $CO_2$ will continue to penetrate into the deep ocean for the

[122] Contribution of IUCN.

[123] See sect. V.F below.

[124] See footnote 1 above.

[125] Contributions of UNDP and FAO. See also the Monaco Declaration, issued at the Second International Symposium on the Ocean in a High-$CO_2$ World, Monaco, 6-9 October 2008.

[126] Contribution of the European Union.

next several centuries.[127] It has therefore been argued that ocean acidification cannot be sufficiently addressed by simply lowering $CO_2$ emissions to the levels currently required under the Kyoto Protocol.[128]

94. Some additional alternative ocean-based physical, biological, chemical, and hybrid mitigation methods have therefore been proposed to sequester $CO_2$. Physical solutions include deep ocean or seafloor $CO_2$ injection, biological solutions include ocean fertilization and chemical solutions include alkalinity addition and enhanced limestone weathering.[129] However, thorough research into their potential effectiveness, cost, safety and scale of application has yet to be undertaken (see sect. C below). Moreover, many proposed geoengineering approaches attempt to provide symptomatic relief from climate change without addressing the root cause of the problem, namely excessive reliance on fossil fuels.[130]

95. Once $CO_2$ has been absorbed by the oceans, there appears to be no practical way at this stage to remove it from the oceans, nor is there any way to reverse its widespread chemical and biological effects.[131] It is therefore important to exercise precaution and prevent further absorption of $CO_2$ by the oceans. Managing marine ecosystems for resilience is also critical.

*Adaptation and managing for resilience*

96. The impacts of ocean acidification are irreversible on short, human-scale, time frames.[132] Thus, in addition to significant reductions in $CO_2$ emissions, ways to manage for resilience and adaptation must be considered to respond to ocean acidification.[133]

97. Selective breeding of one species of oyster shows that resistance to acidification can be increased, suggesting that some level of adaptation may be possible for some organisms. However, the adaptability of most organisms to increasing acidity is unknown.[134] There appears to be high variability in organism and ecosystem responses, and organism acclimatization to ocean acidification will be through gradual shifts. Transgenerational coping abilities and selection and genetic adaptation are also factors of uncertainty in managing for resilience to ocean acidification.[135]

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[127] "Ocean acidification — Studying ocean acidification's effects on marine ecosystems and biogeochemistry", 24 September 2012, at www.whoi.edu/OCB-OA/page.do?pid=112161.

[128] The Royal Society, *Ocean Acidification Due to Increasing Atmospheric Carbon Dioxide*, policy document 12/05 (London, 2005). See also M. Mulhall, "Saving the rainforests of the sea: an analysis of international efforts to conserve coral reefs", Duke Environmental Law and Policy Forum, Spring 2009. See also UNEP/CBD/SBSTTA/16/INF/14; and S. N. Longphuirt and others, "Ocean acidification: an emerging threat to our marine environment", Marine Foresight Series No. 6, 2010.

[129] For an overview of the main ocean carbon cycle geoengineering proposals, the concept behind these ideas and current status of investigation, see C. Nellemann, E. Corcoran, C. M. Duarte, L. Valdes, C. DeYoung, L. Fonseca, G. Grimsditch (Editors), *Blue Carbon: A Rapid Response Assessment* (United Nations Environment Programme, GRID-Arendal, 2009).

[130] "Ocean acidification — Studying ocean acidification's effects on marine ecosystems and biogeochemistry", 24 September 2012.

[131] Contribution of the European Union.

[132] See note 1 above.

[133] UNEP/CBD/SBSTTA/16/INF/14.

[134] See note 1 above.

[135] Contribution of FAO.

98. The severity of the impacts of acidification is likely to depend, in part, on the interaction of acidification with other environmental stresses, such as rising ocean temperatures, overfishing and land-based sources of pollution.[136] Improving resilience of ocean ecosystems and species to the impacts of ocean acidification, primarily by reducing other environmental pressures from marine pollution and destructive fishing practices, including overfishing, is necessary.[137]

99. In that regard, a number of conventional management tools have been suggested as potentially beneficial in maintaining and enhancing resilience of marine ecosystems. These include: effective watershed and coastal management;[138] reduction of local pollutants;[139] implementation of an ecosystem approach, including ecosystem-based fisheries management;[140] exercising adaptive management of fisheries resources and aquaculture operations;[141] using phytoremediation;[142] restoring marine and coastal ecosystems;[143] establishing and effectively managing marine and coastal protected areas and networks thereof;[144] and applying marine spatial planning.[145]

100. Maintenance of coastal habitats such as mangroves will also deliver adaptation benefits by helping to protect coastal communities from the impacts of sea level rise and storm surge.[146] Reducing food and livelihood vulnerability of people via, inter alia, diversification of livelihoods is also a critical element of adaptation.[147] Involving indigenous and local communities in maintaining and restoring ecosystem resilience, as well as in monitoring and in the design and implementation of adaptation programmes is therefore important.[148]

101. While mitigation involves a global commitment, adaptation actions can be adopted at the local and national levels as part of broader efforts to preserve and maintain marine ecosystems.[149] However, local-scale action is likely to have only local-scale effects. Moreover, many national climate change mitigation and adaptation strategies do not yet adequately integrate ocean acidification.[150]

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[136] See note 16 above, Second Symposium on the Ocean in a High-$CO_2$ World.

[137] Contribution of the European Union. See also UNEP/CBD/SBSTTA/16/INF/14.

[138] UNEP/CBD/SBSTTA/16/INF/14.

[139] Ibid.

[140] Ibid. See also the contribution of FAO, based on the conclusions of an IAEA Marine Laboratory-led international workshop on ocean acidification impacts on fisheries and aquaculture, Oceanographic Museum of Monaco, 11-13 November 2012

[141] Contribution of FAO.

[142] Contribution of UNDP.

[143] UNEP/CBD/SBSTTA/16/INF/14.

[144] Contributions of the European Union and IAEA.

[145] Contribution of FAO.

[146] Contribution of UNDP.

[147] Contribution of FAO.

[148] UNEP/CBD/SBSTTA/16/INF/14.

[149] Ibid.

[150] Contributions of the European Union and IUCN.

## C. Assessing the potential impacts of mitigation methods

102. The United Nations Convention on the Law of the Sea requires States to monitor and assess the effects of activities that may pollute the marine environment (arts. 204 and 206).

103. As noted above, a number of physical, biological, chemical, and hybrid mitigation methods have been proposed. However, current knowledge of the efficiency of such mitigation methods and of the potential risks of these initiatives differs significantly.[151] Any increase in the amount of $CO_2$ in the oceans, either natural or human-induced, while potentially able to temporarily remove $CO_2$ from the atmosphere, is likely to exacerbate ocean acidification. This is of particular relevance for geoengineering or macroengineering activities that deliberately attempt to enhance $CO_2$ absorption and sequestration in the oceans with a view to reducing atmospheric $CO_2$ concentrations to mitigate climate change.[152] In addition, the feasibility, effectiveness and cost of these methods has yet to be demonstrated and their acceptability is likely to be problematic thereby making them unlikely viable policy options.[153]

104. For example, questions have been raised about the efficiency of iron fertilization in sequestering $CO_2$ over long time scales and about the impacts of large-scale iron additions on the marine ecosystem.[154] Ocean fertilization bears a high risk of changing ocean chemistry and pH, especially if carried out repeatedly and at a large scale.[155]

105. Injection and subsequent dissolution of $CO_2$ in the deep oceans may isolate $CO_2$ from the atmosphere for several centuries. However, over long time periods, the equilibrium between the atmospheric and seawater $CO_2$ concentrations would be re-established.[156] Storage of $CO_2$ as a liquid or hydrate on the sea floor would only be possible at water depths below 3,000 m owing to its greater density at this depth, and this method may, as a result of the lack of a physical barrier, trigger a slow dissolution of $CO_2$ into the overlying water column. Chemical changes and subsequent biological influences of this type of storage are likely to be significant in light of the inability of deep sea organisms to adapt to rapid changes. Risks also arise from out-gassing into the atmosphere by the possibility of large plumes rising to the sea surface.[157] Injection of $CO_2$ into geological formations, such as deep saline formations and oil and gas reservoirs, below the seafloor may also have impacts on, inter alia, sub-seafloor microbial communities.[158]

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151 C. Nellemann, E. Corcoran, C. M. Duarte, L. Valdes, C. DeYoung, L. Fonseca, G. Grimsditch (Editors), *Blue Carbon: A Rapid Response Assessment* (United Nations Environment Programme, GRID-Arendal, 2009).

152 See note 1 above.

153 Contribution of the European Union. See also C. Nellemann, E. Corcoran, C. M. Duarte, L. Valdes, C. DeYoung, L. Fonseca, G. Grimsditch (Editors), *Blue Carbon: A Rapid Response Assessment* (United Nations Environment Programme, GRID-Arendal, 2009).

154 S. N. Longphuirt, D. Stengel, C. O'Dowd and E. McGovern, "Ocean acidification: an emerging threat to our marine environment", 2010.

155 See note 1 above.

156 See note 127 above.

157 Ibid.

158 Ibid.

106. Uncertainties also exist regarding the efficiency of adding vast amounts of alkaline compounds, such as calcium hydroxide or magnesium hydroxide, in the oceans. The impacts of such measures on the health of marine ecosystems locally, regionally and globally is still largely unknown. Furthermore, the ecological damage resulting from mining and transporting alkaline minerals in sufficient quantities, as would be required for such approaches to effect changes in ocean pH, presents a major concern.[159] For example, it is estimated that over 13 billion tons of limestone would need to be deposited in the oceans annually to counter the acidity impacts from current emissions.[160]

## D. Implementing the applicable legal and policy framework

107. Some of the main elements of the legal and policy framework potentially relevant to addressing ocean acidification and its impacts on the marine environment are set out in section III above. In this regard, some contributions to the report of the Secretary-General raised some issues relating to the implementation of the existing legal and policy framework for addressing the impacts of ocean acidification on the marine environment.

108. For example, in the contribution of the European Union, the United Kingdom expressed the view that a specific issue for consideration was "whether anthropogenic $CO_2$ uptake by the ocean and its subsequent acidification should be considered as a 'pollution of the marine environment' under UNCLOS Article 1".[161] A clear understanding of how the provisions of existing international legal instruments apply to ocean acidification could facilitate their effective implementation.

109. Moreover, the question of the sufficiency of the existing legal and policy framework to address ocean acidification has been raised. In the European Union contribution, France expressed the view that one interesting issue for consideration could be whether the current international legal framework is sufficient for regulating $CO_2$ removal methods and techniques. It was also stated that the absence of a clear legal framework to establish marine protected areas in areas beyond national jurisdiction represents an important regulatory gap that may hamper responses to ocean acidification.[162] The United Kingdom considered that "there [was] urgent need for intergovernmental bodies, such as UNFCCC, to consider what [ocean acidification] specific mitigation and adaptation measures needed to be developed, alongside other mechanisms and efforts".[163] IUCN noted that the General Assembly working groups could provide a venue to also consider the effects of ocean acidification on marine biological diversity.[164]

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[159] See note 1 above.

[160] Rachel Baird and others, "Ocean acidification: a litmus test for international law", *Carbon and Climate Law Review* (2009), pp. 459-471.

[161] Contribution of the European Union.

[162] Ibid.

[163] Ibid.

[164] Contribution of IUCN.

## E. Improving cooperation and coordination

110. The importance of cooperation and coordination is a common thread through all the major ocean-related issues currently faced by the international community. This trend results from the multiplication of actors and stakeholders which are active at the national, regional and global levels as well as in the scientific, legal and diplomatic circles, on the one hand, and from the fragmentation of applicable regimes and the risk of gaps or duplication of efforts, on the other hand.

111. In the case of ocean acidification, these challenges are even greater for a variety of reasons. The scale of ocean acidification implies that concerned stakeholders need to work together at the global level in order to address knowledge gaps, ensure a comprehensive approach to observation and research, standardize research methodologies and develop, maintain and share relevant data. Furthermore, ocean acidification poses an interdisciplinary research problem, thus covering a large number of fields that go beyond science and involve ecological, social, economic and legal disciplines.

112. In this regard, it is encouraging to note that there are a number of recent initiatives focused, exclusively or not, on cooperation and coordination. They illustrate how one of the challenges outlined above, namely the relatively recent inclusion of ocean acidification in the agendas of ocean policymakers, can also represent an opportunity. Such initiatives include the establishment of the Ocean Acidification International Coordination Centre (see para. 59 above), the General Assembly Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects (Regular Process) and the initiative of the Secretary-General, "Oceans Compact".[165]

113. **Regular Process**. The task of the first cycle of the Regular Process, which is expected to be completed by 2014, will be to produce the First Global Integrated Marine Assessment of the world's oceans and seas. Ocean acidification is included in the outline among the topics to be covered by the First Global Integrated Marine Assessment. Ocean acidification will be dealt with in connection with sea/air interaction as well as ocean-sourced carbonate production. The Assessment will contain an evaluation of the environmental, economic and social implications of trends in ocean acidification, in recognition of its cross-sectoral nature and in keeping with the mandate of the Regular Process.[166]

114. **Oceans Compact**. The initiative of the Secretary-General, "Oceans Compact — Healthy Oceans for Prosperity",[167] is aimed at strengthening United Nations system-wide coherence and fostering synergies in oceans matters towards achieving the common goal of healthy oceans for prosperity. One of its objectives is to strengthen ocean-related knowledge including through ocean observation networks and with regard to ocean acidification.

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[165] See www.un.org/Depts/los/index.htm.

[166] See www.worldoceanassessment.org/pdf/ApprovedOutlineApril2012.pdf.

[167] See www.un.org/Depts/los/ocean_compact/oceans_compact.htm.

## F. Capacity-building

115. The United Nations Development Programme noted that "capacity is not a passive state but part of a continuing process" and that "human resources are central to capacity development". As such, it progressively expands to address the needs that emerge as developing countries face new challenges, such as ocean acidification.[168]

116. There is a strong need for capacity-building with regard to ocean acidification. Ocean acidification is a relatively new field of study, thus requiring considerable scientific and policy-oriented start-up work and investments. The development of policies to address ocean acidification needs to be supported by sound, and costly, scientific monitoring and assessment. Following their development, such policies have to be adopted and implemented at the national, regional and global levels. In view of the scientific and technical complexities of the problem of ocean acidification, both policymaking and policy adoption and implementation can prove very challenging for developing countries, in particular small island developing States.

117. The lack of financial resources, especially in the context of the current global economic crisis, is one of the most common challenges to capacity-building. In this context, it can be quite difficult for a new area of expertise such as ocean acidification to establish its place on the list of activities requiring capacity-building resources. In this regard, it may be important to take advantage of all available sources of related capacity-building, such as that related to addressing climate change and for the Regular Process, as well as increased sharing of resources and know-how through North-South and South-South cooperation.

118. Despite these difficulties, several institutions seem to have included ocean acidification among the areas on which to focus their capacity-building initiatives. At this stage, however, many of these initiatives seem to focus on the need to build capacity for raising awareness about the threats posed by ocean acidification. This is the case, for instance, of the Convention on Biological Diversity, which encourages its parties to support capacity-building and training for communication of ocean acidification across key sectors and stakeholders (policymakers, research funders, public and media).

119. Whereas the current scenario of financial constraints poses a fundamental challenge to capacity-building, it also offers the international community with the opportunity to fine-tune how financial resources are invested in capacity-building. A precise identification of the needs of developing countries in the area of ocean acidification, the selection of suitable partners locally, the careful design of short-, mid-, and long-term indicators of achievement become imperative in this climate but may lead to a more effective delivery of capacity-building.

120. The lack of coordination among capacity-building providers often counters their beneficial effects. The coordination of capacity-building activities involving oceans and the law of the sea, in particular within the United Nations system, has

[168] UNDP — Management Development and Governance Division Bureau for Development Policy, *Capacity Assessment and Development in a Systems and Strategic Management Context — Technical Advisory Paper No. 3*, p. 5, available at http://mirror.undp.org/magnet/Docs/cap/CAPTECH3.htm.

been emphasized as a prerequisite to ensure a targeted approach and to prevent fragmentation or duplication of effort.[169]

121. In this connection, it is important to note that one of the functions of the Ocean Acidification International Coordination Centre (see para. 112 above) will also be to coordinate capacity-building, for example, through short training courses, while also promoting efficient linkages between national ocean acidification research communities and the wide range of international and intergovernmental bodies with interest in this problem.

## VI. Conclusions

122. Considerable knowledge gaps remain regarding the biological and biogeochemical consequences of ocean acidification for marine biodiversity and ecosystems, and the impacts of these changes on marine ecosystems services, including food security, coastal protection, tourism, carbon sequestration and climate regulation. However, what is known is that ocean acidification operates in synergy with other pressures on marine ecosystems to compromise the health and continued functioning of those ecosystems.

123. While ocean acidification is often perceived as a symptom of climate change, it is a significant, separate, problem which requires specific attention and measures. Although increased emission of $CO_2$ into the atmosphere contributes to both phenomena, the processes and impacts of ocean acidification and climate change are distinct. For example, greenhouse gases other than $CO_2$ do not affect ocean acidification. Moreover, the absorption of $CO_2$ into the oceans may, at least in the short-term, help to mitigate the effects of climate change, even though it exacerbates ocean acidification.

124. The future magnitude of ocean acidification and its impacts on the marine environment and related socioeconomic impacts are considered to be very closely linked to the amount of $CO_2$ released and accumulated in the atmosphere as a result of human activities. Significant and rapid mitigation measures are therefore urgently needed. Similarly, given the economic and social importance of the oceans to human societies, governments at the local, national, and international levels are encouraged to assess and implement adaptive approaches to acidification.

125. Activities to increase our knowledge of the ocean acidification process and its impacts, as well as to address them, have increased over the past few years. However, thus far, few measures have been taken to effectively mitigate or adapt to the impacts of ocean acidification on the marine environment. In addition, these activities and initiatives appear to be fragmented. In particular, greater efforts are needed to coordinate research on ocean acidification in order to avoid gaps and duplications. For example, further research is needed to understand the impacts of mitigation methods as well as the degree to which acidification impacts can be offset by reducing other environmental stresses and an optimal management of marine ecosystems to counter these and other combined threats. With too many unknown variables and current modelling limitations, assessment of the risks and consequences of new proposals for mitigation of ocean acidification is a challenge. In the light of the limited experience with alternative mitigation methods and scarce

[169] See A/65/164, para. 52.

impact assessments undertaken in their regard, it is therefore important to exercise precaution and avoid mitigation strategies that may exacerbate ocean acidification.

126. The capacity to mitigate ocean acidification and adapt to its impacts, including through the adoption of management measures to ensure or strengthen the resilience of ecosystems is a critical element of addressing ocean acidification. In that regard, greater emphasis should be put on capacity-building to promote the sharing of knowledge and expertise as well as the development of infrastructure and domestic policies related to ocean acidification. Capacity-building activities directed towards developing countries whose communities are most affected by the impacts of ocean acidification, owing to their dependency on organisms vulnerable to acidification, is critical. For example, many of the small island nations have few economic alternatives to fishing to supply both income and protein.

127. Given that ocean acidification is a global issue that requires a global approach and an integrated response, there is an urgent need for intergovernmental bodies to consider the challenges and opportunities for effectively addressing the ocean acidification impacts on the marine environment, including through international cooperation and coordination. For present and future generations, the cost of taking the urgent and necessary steps to mitigate and adapt to ocean acidification is likely to be lower than the cost of inaction.